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bulletin of
Duke University
1993-94

Undergraduate Instruction



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Undergraduate Instruction

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University Calendar—1993-94

Summer 1993*

March	
27	Saturday—Beginning of registration for Term I and /or Term II
May	
12	Wednesday—Last day for registration and payment of Term I fees without \$25 late fee (before 4:00 P.M.)
20	Thursday—Term I classes begin
25	Tuesday—Drop / Add for Term I ends at 4:00 P.M.
June	
25	Friday—Last day for registration and payment of Term II fees without \$25 late fee (before 4:00 P.M.)
30	Wednesday—Term I final examinations begin
July	
1	Thursday—Term I final examinations end
5	Monday—Term II classes begin
7	Wednesday—Drop / Add for Term II ends at 4:00 P.M.
August	
13	Friday—Term II final examinations begin
14	Saturday—Term II final examinations end

Fall 1993

August	
26	Thursday—Orientation begins; assemblies for all new undergraduate students
30	Monday, 8:00 A.M.—Fall semester classes begin
September	
6	Monday—Labor Day, classes in session
10	Friday—Drop / Add ends
October	
15	Friday—Last day for reporting midsemester grades
15	Friday, 6:00 P.M.—Fall break begins
20	Wednesday, 8:00 A.M.—Classes resume
23	Saturday—Registration begins for spring semester, 1994
29-31	Friday-Sunday—Homecoming
November	
5-7	Friday-Sunday—Parents' Weekend
19	Friday—Registration ends for spring semester, 1994
22	Monday—Drop / Add begins
24	Wednesday, 12:30 P.M.—Thanksgiving recess begins
29	Monday, 8:00 A.M.—Classes resume
December	
9	Thursday, 6:00 P.M.—Fall semester classes end
10-12	Friday-Sunday—Reading period
12	Sunday—Founders' Day
13	Monday—Final examinations begin
18	Saturday—Final examinations end

*The School of the Environment, the Fuqua School of Business, the Marine Laboratory, the Graduate Nursing Program, and Physical Therapy may have different starting dates during the summer; consult the appropriate bulletins and schedules.

Spring 1994

January
5 Wednesday—Registration and matriculation of new undergraduate students
6 Thursday, 8:00 A.M.—Spring semester classes begin
19 Wednesday—Drop/Add ends

February
18 Friday—Last day for reporting midsemester grades

March
4 Friday, 6:00 P.M.—Spring recess begins
14 Monday, 8:00 A.M.—Classes resume
19 Saturday—Registration begins for fall semester, 1994, and summer, 1994

April
8 Friday—Registration ends for fall semester, 1994; summer registration continues
11 Monday—Drop/Add begins
20 Wednesday, 6:00 P.M.—Spring semester classes end
21-24 Thursday-Sunday—Reading period
25 Monday—Final examinations begin
30 Saturday—Final examinations end

May
6 Friday—Commencement begins
8 Sunday—Graduation exercises. Conferring of degrees



University Administration

GENERAL ADMINISTRATION

Nannerl Overholser Keohane, Ph.D., *President*
Thomas A. Langford, Ph.D., *Provost*
Ralph Snyderman, M.D., *Chancellor for Health Affairs and Dean, School of Medicine*
Charles E. Putman, M.D., *Executive Vice-President for Administration*
Eugene J. McDonald, LL.M., *Executive Vice-President-Asset Management*
Joel L. Fleishman, LL.M., *First Senior Vice-President*
John F. Burness, A.B., *Senior Vice-President for Public Affairs*
John J. Piva, Jr., B.A., *Senior Vice-President for Alumni Affairs and Development*
John F. Adcock, B.S., *Vice-President and Corporate Controller*
Leonard C. Beckum, Ph.D., *University Vice-President and Vice-Provost*
Tom A. Butters, B.A., *Vice-President and Director of Athletics*
Janet Smith Dickerson, M.Ed., *Vice-President for Student Affairs*
Thomas E. Dixon, A.B., *Vice-President for Administrative Services*
J. Peyton Fuller, A.B., *Vice-President, Planning and Treasurer*
William J. Donelan, B.A., M.S., *Vice-Chancellor and Chief Financial Officer for Medical Center Administration*
Gordon G. Hammes, Ph.D., *Vice-Chancellor for Medical Center Academic Affairs*
Mark C. Rogers, M.D., *Vice-Chancellor for Health Services and Executive Director of Duke University Hospital*
R. C. Bucky Waters, B.S., M.A., *Vice-Chancellor for Medical Center Development*
David B. Adcock, J.D., *University Counsel*
N. Allison Haltom, A.B., *Secretary of the University*
William H. Willimon, M.Div., S.T.D., *Dean of the Chapel*

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Paula P. Burger, Ph.D., *Executive Vice Provost*
Lewis M. Siegel, Ph.D., *Vice-Provost for Interdisciplinary Activities and Dean of the Graduate School*
Richard A. White, Ph.D., *Vice-Provost for Undergraduate Education and Dean of Trinity College*
Margaret Bates, Ph.D., *Vice-Provost for Academic Programs*
Jerry D. Campbell, Ph.D., *Vice-Provost for Library Affairs, University Librarian, and Vice-Provost for Computing*
Albert F. Eldridge, Ph.D., *Assistant Provost and University Registrar*
James S. Roberts, Ph.D., *Assistant Provost for Financial Affairs*
David Jamieson-Drake, Ph.D., *Director of Institutional Research*

Arts and Sciences

Malcolm Gillis, Ph.D., *Dean of the Faculty of Arts and Sciences*
Charles W. Byrd, Ph.D., *Associate Dean for Academic Affairs*
Thomas D. Mann, A.B., *Assistant Dean for Administration*
Susan C. Ross, A.B., *Associate Dean and Director of Development for Arts and Sciences*
Steven C. Thweatt, B.Arch., *Assistant Dean for Facilities*

Trinity College

Richard A. White, Ph.D., *Dean and Vice-Provost for Undergraduate Education*
Lee W. Willard, Ph.D., *Associate Dean for Academic Planning and Special Programs*
Gerald L. Wilson, B.D., Ph.D., *Senior Associate Dean for Administration; Social Sciences and Pre-Law*
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Mary Nijhout, Ph.D., *Associate Dean for Natural Sciences and Pre-Graduate School Advisor*
Ellen W. Wittig, Ph.D., *Associate Dean for Humanities*
Christa T. Johns, Ph.D., *Associate Director of Foreign Academic Programs and Assistant Dean for Study Abroad*
Caroline L. Lattimore, Ph.D., *Assistant Dean for Social Sciences*
Judith G. Ruderman, Ph.D., *Assistant Dean for Summer Session and Continuing Education*
Kay H. Singer, Ph.D., *Assistant Dean for Natural Sciences, Director of Health Professions Advising Center, and Director of Center for Science Education*
John W. Zarker, Ph.D., *Interim Assistant Dean for Pre-Majors and Interim Director of the Pre-Major Advising Center*
Calvin L. Ward, Ph.D., *Director of Foreign Academic Programs*

School of Engineering

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Marion L. Shepard, Ph.D., *Associate Dean for Academic Affairs*

Student Affairs

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Christopher Chafe, B.A., *Director, Community Service Center*

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Richard O'Dor, M.A., *Director, Duke Debate*

Carlisle C. Harvard, B.A., *Director, International House*

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Karen Steinour, Ph.D., *Dean for Residential Life*

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Peter J. Coyle, Jr., B.A., *Associate Director, University Union*

Martha Abshire Simmons, B.A., *Director, Women's Center*

Admissions and Financial Aid

Christoph O. Guttentag, B.A., M.A., *Director of Undergraduate Admissions*

James A. Belvin, Jr., A.B., *Director of Undergraduate Financial Aid*

General Information



Duke University

In 1839 a group of citizens from Randolph and adjacent counties in North Carolina assembled in a log schoolhouse to organize support for a local academy founded a few months earlier by Brantley York. Prompted, they said, by "no small share of philanthropy and patriotism," they espoused their belief that "ignorance and error are the banes not only of religious but also civil society which rear up an almost impregnable wall between man and happiness." The Union Institute, which they then founded, was reorganized in 1851 as Normal College to train teachers, and again in 1859 as Trinity College, a liberal arts college, which later moved from the fields of Randolph County to the growing city of Durham, North Carolina. Trinity College was selected by James B. Duke as the major recipient of a fortune when, in 1924, he provided endowment funds for the university that would be organized around Trinity College and named for the Duke family.

The old Trinity College had, like almost all institutions in America at the time it was founded, been restricted to men. In 1896, Washington Duke gave an endowment with the condition that women be admitted "on equal footing with men." Thereafter, women were educated in Trinity College, and in 1930 the Woman's College was established as a separate college. Trinity College and the Woman's College continued as coordinate colleges for over forty years. To assure that women were indeed admitted "on equal footing with men," and to recognize that the education which men and women had received at Duke had long taken place in the same classrooms, the University merged these coordinate colleges in 1972 to form Trinity College of Arts and Sciences, the liberal arts undergraduate college of the University. The Bachelor of Arts and Bachelor of Science degrees may be earned in the college.

Instruction in engineering started at Normal College in 1851 and was continued at Trinity College as an option in the arts and sciences program. A Department of Engineering was established at Trinity in 1910. Following the establishment of Duke University in 1924, the Departments of Civil and Electrical Engineering were formed in 1927, and a Department of Mechanical Engineering was added four years later. The three engineering departments were joined to form the Division of Engineering as a separate administrative unit of the University. In 1939 this division was renamed the College of Engineering, which in 1966 became a professional school of engineering. The Division of Biomedical Engineering was added to the School of Engineering in 1967, and it was recognized as a department in 1971. In 1974 the name of the mechanical engineering department was changed to the Department of Mechanical Engineering and Materials Science; in 1982, the Department of Civil Engineering was renamed the Department of

Civil and Environmental Engineering. All four departments offer courses leading to Bachelor of Science in Engineering, Master of Science, and Doctor of Philosophy degrees.

The School of Nursing was established in 1931 in association with the School of Medicine and Duke Hospital. From 1944 until 1984, the Bachelor of Science in Nursing Education degree was offered. In 1980, the University Board of Trustees approved the phaseout of the existing undergraduate degree programs. At present, the School of Nursing offers courses leading to the Master of Science in Nursing degree, a program initiated in 1958.

As the University developed around the core of undergraduate colleges and schools, the Graduate School, organized in the 1920s, expanded in areas of instruction and research. It now consists of some fifty-five departments and programs and offers A.M., M.S., M.A.T., M.P.P., and Ph.D. degrees. In 1930, the School of Law of Trinity College was established as a graduate professional school, the Duke University School of Law, and was followed by other professional schools. The Divinity School was organized in 1926 and the School of Medicine in 1930. The School of Forestry which began in 1938 grew into the School of Forestry and Environmental Studies in 1974, and was restructured to become the School of the Environment in 1991. The Graduate School of Business Administration was established in 1969 and renamed the Fuqua School of Business in 1980.

Duke, a privately supported, church-related (Methodist) university, has over 10,000 students enrolled in degree programs. These students represent nearly every state and many foreign countries; Duke has more than 85,000 alumni in all fifty states and in numerous foreign countries. The University is a member of the North Carolina Association of Independent Colleges and Universities, the Southern Association of Colleges and Schools, and the Association of American Universities.

From academy to university, some of the basic principles have remained constant. The Duke University motto, *Eruditio et Religio*, reflects a fundamental faith in the union of knowledge and religion, the advancement of learning, the defense of scholarship, the love of freedom and truth, a spirit of tolerance, and a rendering of the greatest service to the individual, the state, the nation, and the church. Through changing generations of students, the objective has been to encourage individuals to achieve, to the extent of their capacities, an understanding and appreciation of the world in which they live, their relationship to it, their opportunities, and their responsibilities.

Resources of the University

The Faculty. The University faculty, numbering approximately 1,900, maintains a tradition of personal attention to students and devotion to research. Many members of the faculty are, and have been, cited for excellence in teaching and are elected to membership in the national societies which honor those best in scholarship and research. Leaders in their disciplines and their professional organizations, they are authors of significant books and articles. Members of the faculty also act as consultants to industry, government, and foundations. To honor its outstanding faculty, the University has established more than one hundred James B. Duke and other named professorships.

The Library System. The libraries of the University consist of the William R. Perkins Library and its seven branches on campus: Biology-Forestry, Chemistry, Divinity, Lilly (East Campus), Engineering, Music, Mathematics-Physics; the Pearse Memorial Library at the Duke Marine Laboratory in Beaufort; and the independently administered libraries of Law, Medicine, and Business (Fuqua). As of June 1992, these libraries contained over 4,100,000 volumes. The collection includes 9.5 million manuscripts, and over 2,000,000 public documents.

The William R. Perkins Library. The William R. Perkins Library, the main library of the University, houses most of the books and journals in the humanities and social sciences, as well as large files of United States federal and state documents and public

documents of many European and Latin American countries. Included also are publications of European academies and learned societies, and special collections from South Asian, Far Eastern, and Slavic countries, and the country's most extensive collection of Canadiana. The newspaper collection, with over 700,000 microform pieces, has several long eighteenth-century files; strong holdings of nineteenth-century New England papers; and antebellum and Civil War papers from North Carolina, South Carolina, Virginia, and Georgia; as well as many European and Latin American papers. The manuscript collection of approximately 9.5 million items is particularly strong in all phases of the history, politics, and social and economic life of the South Atlantic region; it also includes significant papers in English and American literature and the J. Walter Thompson Advertising Archives. The rare books collection contains many scarce and valuable materials covering a broad range of fields. Its Latin and Greek manuscripts constitute one of the outstanding collections of its kind in the United States, and the collection of Confederate imprints is one of the largest in the country.

The Reserves and Media Department houses the required reading materials placed on reserve for most graduate and undergraduate courses as well as the Paul B. Williams Media Center. This state-of-the-art facility contains videocassette players, laser disk players, and the audiovisual collection of films and videocassettes. The branch libraries serve the academic disciplines whose names they bear. The Lilly Library is primarily for undergraduate use, but it also contains the principal collections for graduate and undergraduate study in art and the performing arts.

Since the libraries at Duke, the University of North Carolina at Chapel Hill, and North Carolina State University are joined by a computer network, members of the Duke community can easily and quickly determine what books and other library materials are held by UNC and NCSU. Through a reciprocal borrowing agreement, faculty and students at Duke may borrow materials from both of these libraries.

Reference librarians are on duty in Perkins Library for most of the hours the library is open. Their primary responsibility is to assist patrons in making the most effective use of library collections and facilities. In addition to answering specific questions, the reference librarians also help patrons access information by identifying and explaining the use of library sources and by giving formal and informal instruction to groups of students, faculty, or staff. Professional reference service is available to students in all other campus libraries.

Tours of the Perkins Library are given frequently during Orientation Week and upon request throughout the year. Information about other campus libraries may be obtained from the staff in each of the libraries. Handbooks about library services and facilities are also available in each of the libraries.

The library has both microfilming and copying services. The rules with regard to copyright and a schedule of fees for reproduction services are available in the library at the point of service.

The Medical Center Library. The Medical Center Library, located in the Seeley G. Mudd Communications Center and Library Building, provides the services and collections necessary to further educational, research, and clinical activities in the medical field. Services are available to the students, faculty, and staff of the School of Medicine; of the Division of Allied Health; of Duke Hospital; and of the graduate departments in the basic medical sciences. Other students and faculty needing access to biomedical literature may apply for privileges upon application to the Head of the Circulation Department.

Over 260,000 volumes are available, including the Trent Collection in the History of Medicine. Approximately 3,000 journal subscriptions are received currently, in addition to extensive back files of older materials. The library has several types of audiovisual materials and equipment. With the exception of certain items shelved on reserve, these materials have been shelved after the general book collection or integrated into the journal collection and are listed in the card or journal catalogs. The Frank Engel

Memorial Collection consists of a small group of books on nonmedical subjects for general reading, together with several newspapers and popular magazines. Traditional reference services are supplemented by on-line bibliographic systems and computer-produced specialized indexes. Photocopy service is available to eligible students, faculty, and staff. Copyright information and a schedule of fees are available in the library at the point of service.

The uniform borrowing privileges apply to all registered users. Details of loan and other services may be found in the guide which is published each year and is available at the library.

The School of Law Library. The School of Law Library, with over 430,000 volumes, serves both the University and the local legal community. It features comprehensive coverage of basic Anglo-American primary source materials, including nearly all reported decisions of federal and state courts, as well as current and retrospective collections of federal and state codes and session laws. Digests, legal encyclopedias, and other indexing devices provide access to the primary documents. A large section of the library collection is devoted to treatises on all phases of law and legal sciences, as well as history, economics, government, and other social and behavioral sciences relevant to legal research. The treatises are organized in the Library of Congress classification system and most are accessible through the Duke University online catalog. Special treatise collections are maintained in several subject areas, including the George C. Christie collection in jurisprudence and the Floyd S. Riddick collection of autographed senatorial material. The library is a selective depository for United States government publications, with concentration on congressional and administrative law materials. The library receives the records and briefs from the United States Supreme Court, the Fourth Circuit Court of Appeals, and the North Carolina Supreme Court and Court of Appeals. In addition to its Anglo-American holdings, the library holds substantial research collections in foreign and international law. The foreign law collection is extensive in coverage, with concentrations in European law and business law materials. The international law collection is strong in primary source and treatise material on both private and public international law topics. Undergraduate and graduate students whose course of study requires access to legal literature may use the library. However, access to the library may be restricted during certain times because of accreditation standards.

Music Library and Music Media Center. The Music Library, located in Room 113 of the Mary Duke Biddle Music Building, and the Music Media Center, located in Room 027 of the same building, are administered as a single branch library within the Perkins Library system. The Music Library contains a rapidly expanding collection of scholarly reference materials, books on music, music scores, and over 200 journals in the field. The Music Media Center contains facilities for listening to compact discs, cassettes, LP recordings, and for viewing laser discs, videotapes, and microforms.

University Archives. The Duke University Archives, the official archival agency of the University, collects, preserves, and administers the records of the University having continuing administrative or historical value. The institutional archives, which also include published material, photographs, papers of student groups and faculty, and selected memorabilia, are available for research under controlled conditions in 341 Perkins Library.

Computer ASSIST Center. For a contemporary university, extensive computing resources are essential. At Duke, the Computer ASSIST Center is the organization that works in partnership with members of the University community to enable them to achieve their goals through computing.

The Computer Assist Center provides access to a variety of computing facilities and services. Through Duke's connection to the national Internet data network, students can gain access to the Cray Y-MP/432 at the North Carolina Supercomputing Center and to

other supercomputing centers. Mainframe service for Duke is provided on an IBM ES-9000 computer at the Duke University Computation Center (DUCC) located in the North building.

Access to these supercomputer, mainframe, and minicomputer systems is provided by campus facilities connected by telecommunications links. These include some of the MS-DOS, Macintosh, and workstation clusters described below. In addition, anyone with a personal computer, modem, and telephone line can connect to these computers by dialing into a central dataswitch, or by connecting their computer to the new high speed data network, DukeNet, where available.

The Computer ASSIST Center also supports extensive personal computer and workstation services located throughout the campus. There are three laboratories of MS-DOS based personal computers housed in the North, Engineering, and West Duke buildings, and thirteen public clusters of both MS-DOS and Apple Macintosh personal computer systems spread throughout the University. The six workstation laboratories contain DEC equipment and are located in the North, Sociology-Psychology, Biological Sciences, Carr, and Engineering buildings. All laboratories and clusters are equipped with either dot matrix or laser printing facilities, and several are connected to the campus telecommunications network. While there is a nominal charge for the use of the laser printers, there is no charge for the use of the personal computers.

Funds for using the Duke mainframe come from outside grants and contracts and from University funds. Several schools within the University, such as Arts and Sciences and Engineering, may apply for funding specifically designated for use at Duke. Faculty and graduate students in these schools may apply for a Duke account. Any student may request a free account for electronic mail services on the workstation systems. More specific information regarding Duke computing facilities may be obtained by calling the Computer ASSIST Center Consulting Desk at 660-2983, 9:00 A.M. to 5:00 P.M., Monday through Friday.

Science Laboratories. In addition to the teaching and research laboratories in the departments of natural and social sciences and in the School of Engineering, there are other facilities in which some advanced undergraduates work on individual projects. These include the Duke University Marine Laboratory in Beaufort, North Carolina; the Phytotron of the Southeastern Plant Environment Laboratories, located on the Duke campus; the Duke Forest, adjacent to the campus; the Duke University Primate Center in Duke Forest; the Triangle Universities Nuclear Laboratory; and the Free Electron Laser Laboratory, also on campus. Construction is also underway on campus on the new Levine Science Research Center.

Duke as a Residential University

Duke has a long tradition as a residential university and has sought to provide for the great majority of the undergraduates convenient on-campus housing in both residence halls and apartments. While the University was established to provide a formal educational opportunity for students, Duke has always taken the position that education encompasses social and personal development as well as intellectual growth. In order to facilitate such a holistic approach, Duke seeks to provide a supportive environment substantially anchored in its residential program.

Educational, cultural, and outdoor adventure programming is planned and presented throughout the year for living groups through the cooperative work of the Office of Residential Life, Trinity College of Arts and Sciences, the School of Engineering, and resident students. There are a number of faculty members who live in residence halls. Faculty offices and seminar rooms are also located in several houses. The goals of these various programs are to enhance the quality of intellectual and social life for the residents on campus, to facilitate student-faculty interaction outside of the formal classroom, and

to develop a greater sense of community within the individual residence halls as well as within the greater University.

The Undergraduate College and School

In Trinity College of Arts and Sciences and the School of Engineering, instruction is offered by University faculty who engage in research and in graduate and undergraduate teaching. Duke offers its undergraduates the opportunity to study with many internationally recognized experts in their disciplines and with faculty members who are jointly committed to undergraduate instruction and to the advancement of knowledge. The University recognizes that students learn not only through formal lectures, but also through the interplay of ideas among faculty members and students; thus, it offers undergraduates opportunities to test their ideas against those of their professors and to observe at close range those who have committed their lives to academic careers.

The University, if it is doing its job properly, is educating citizens of the United States and of the world, not only individuals aspiring to personal fulfillment. At Duke, the men and women who earn degrees are likely to become leaders in industry, government, and the professions. They will have influence on and will be influenced by the social fabric of which they are a part. The kind of people they become will matter not only to them and their families, but also to their communities, to the United States, and to the countries of the rest of the world as well.

Amidst changing external conditions, the University must ensure that students acquire the tools and flexibility to prepare them for life-long learning activities.

Trinity College of Arts and Sciences. In Trinity College, the liberal arts are a means through which students explore the world of ideas from art and music to neurosciences and physics. The undergraduate program, rated one of the finest in the country, helps students learn how to deal successfully with the challenges, intellectual and philosophical, that modern life provides. Trinity College is a community of outstanding students and talented, nationally-ranked faculty. As members of this community, students learn to ask questions, analyze rationally, challenge ideas, and contribute to the continuing development of knowledge.

The Trinity experience offers a traditional liberal arts base of study and currently requires, within broad limits, exposure to great ideas in six major areas: arts and literatures, civilizations, foreign languages, quantitative reasoning, natural sciences, and social sciences. It offers exposure across a broad spectrum as well, and interdisciplinary and interdepartmental programs stretch horizons even further. Internships and apprenticeships in areas related to students' majors are increasingly available so that practical experience can complement a more formal education. In a world where people are drawn ever closer together, the understanding of cultural difference and diversity becomes increasingly important. Our study abroad programs are varied and plentiful.

The undergraduate college of arts and sciences is unique in that it is set within a distinguished research university. We believe that this combination provides unparalleled opportunities for interaction with faculty, both inside and outside the classroom. The arts and sciences faculty boasts some of the most highly rated scholar-teachers in the country. They challenge students both to master and to reach beyond the basics of fundamental knowledge. At Duke there is a genuine concern for learning, and students are prepared by academic challenges and their individual experiences for the critical decision-making required of them for participatory citizenship, full personal lives, and successful careers.

School of Engineering. The undergraduate engineering program at Duke University is designed both for students who intend to become professional engineers and for those who desire a modern, general education based on the problems and the promises of a technological society. The environment in which students are educated is as important in shaping their future as their classroom experiences. In the Duke School of

Engineering this environment has two major components: one is modern technology derived from the research and design activities of faculty and students in the school; the other is the liberal arts environment of the total University, with its humanitarian, social, and scientific emphases.

Engineering is not a homogeneous discipline; it requires many special talents. Some faculty members in the School of Engineering are designers; they are goal-oriented, concerned with teaching students how to solve problems—how to synthesize relevant information and ideas and apply them in a creative, feasible design. Other engineering faculty members function more typically as scientists; they are method-oriented, using the techniques of their discipline in their teaching and research to investigate various natural and artificial phenomena.

Degree Programs



Degrees and Academic Credit

Duke University offers in Trinity College of Arts and Sciences the degrees of Bachelor of Arts and Bachelor of Science, and in the School of Engineering the degree of Bachelor of Science in Engineering. Within the curriculum of each college or school, students have the major responsibility for designing and maintaining a course program appropriate to their background and goals. They are assisted by faculty advisors, departmental Directors of Undergraduate Studies, and academic deans.

Credit toward a degree is earned in units called semester courses (s.c.), commonly abbreviated as courses. These courses ordinarily consist of three to four hours of instruction each week of the fall or spring semester or the equivalent total number of hours in a summer term. Double courses, half courses, and quarter courses are also recognized.

Trinity College of Arts and Sciences

A variety of approaches to a liberal education is provided by Program I and II. Either program leads to the Bachelor of Arts or Bachelor of Science degree, and each requires thirty-four semester courses.

PROGRAM I

Program I provides for the experience and achievement that constitute a liberal education. The ability to organize ideas and to communicate them with clarity and precision is refined by completing the writing course and by the requirement for discussion in small groups. Knowledge of a foreign language contributes to an understanding of the nature of language itself and to perspectives on other cultures. Through courses in arts and literatures students learn about the creative products of the human intellect; courses about civilizations ask students to attend to the analysis and evaluation of ideas and events that shape civilizations past and present. Through courses in natural sciences students learn how to interpret and utilize information in an increasingly technological world, while courses in quantitative reasoning help develop skills of inference and analysis. Finally, through courses in the social sciences students learn about the causes of human behavior and about the origins and functions of the social structures in which we operate.

Students must complete the requirements listed below and explained, where necessary, on the following pages. No degree requirements, except the requirement for

thirty-four course credits and continuation requirements, may be met by a course passed under a pass/fail option unless the course is offered only on that basis.

Writing. Students are required to demonstrate ability to write effective English prose by completing a course in expository writing, ordinarily University Writing Course 4, 5, 6, 7, or 8. See the section University Writing Program in the chapter "Courses of Instruction."

General Studies consisting of courses in five of the following six areas of knowledge:

Arts and Literatures (AL)
Civilizations (CZ)
Foreign Languages (FL)
Natural Sciences (NS)
Quantitative Reasoning (QR)
Social Sciences (SS).

- In four of these areas a student must take three courses. Two of these three courses in each area must be related (see below), and at least one of the three in each area must be at the 100-level.
- In the remaining area a student must take two courses.
- Advanced placement credits will *not* substitute for courses in these areas.
- Courses counting toward requirements in a major (and additional courses taken in the major department) do not count toward more than two of these areas.

The Major consists of the requirements for majors in the department or program in which a student wishes to obtain a bachelor's degree (see below). These requirements are described under the course listing for each department or program. Advanced placement courses may substitute for courses in the major as described by each department.

Elective courses. Advanced placement credits may function as elective courses. Courses that a student is using as electives may or may not carry an area of knowledge designation.

Small Group Learning Experiences.

- Before reaching junior status: at least one full course designated as a seminar, tutorial, or independent study; or a combination of two preceptorials or discussion sections.
- During the junior and senior years: at least two full courses designated as seminars, tutorials, independent study, or a thesis.

Course credits. There are several separate and specific requirements concerning course credits in Trinity College. Thirty-four (34) courses are required for graduation, not more than two with a grade of D, and including:

- At least seventeen (17) at Duke (including the senior year).
- At least twenty-one (21) outside the first major department.
- For any major (including courses that the major department or program requires outside itself): a department or program may require no more than seventeen (17) total for a Bachelor of Arts major and no more than nineteen (19) for a Bachelor of Science major.
- At least twelve (12) courses at or above the 100-level.
- No more than: one credit of physical education activity (i.e., two half-credit activity courses), four credits of dance/American Dance Festival technique/performance (i.e., eight half-credit courses), two credits for house courses (i.e., four half-credit house courses), six from a professional school (e.g., business, engineering, medicine), and four in military science.

Quality of Work. Passing grades are expected in all course work, but see pages below for minimum continuation requirements. Students accept personal responsibility for understanding and meeting the requirements of the curriculum.

General Studies (Distribution of Courses). Students achieve breadth and balance of intellectual experience by taking courses in at least five of the six areas of knowledge. Courses that can be taken to satisfy the distribution requirement are identified in the bulletin by a two-letter code (AL, CZ, FL, NS, QR, SS). In four of the areas of knowledge a student must take at least three courses. At least one of the three courses must be at the 100 or 200 level and at least two of the three courses must be related (see below). In one additional area of knowledge a student is required to take at least two courses. Courses counting toward requirements in a major (and additional courses taken in the major department) do not count toward more than two of these areas.

Related Courses. Students achieve a measure of depth in their general course of study by taking at least two related courses that support or complement each other in each of four areas of knowledge. The related course work provision stimulates students to make considered choices about their course distribution. It encourages the choice of courses that develop a special interest in depth, of courses that extend and enhance what a student has already learned, or of courses that build on each other to develop an area in greater depth than can be explored in a single semester. Related courses may be, for example, a defined two-course sequence (such as Mathematics 31, 32), a course and its prerequisite, or two courses that are used to develop topical, geographic, or temporal connections. Choices of related courses are made in consultation with a faculty advisor.

The Major. Students are expected to acquire some mastery of a particular discipline or interdisciplinary area as well as to achieve a breadth of intellectual experience. They therefore complete a departmental major, an interdisciplinary major, or an interdepartmental concentration. At least half the courses for a student's major field must be taken at Duke although departments may make exceptions to this rule in special circumstances. Students are responsible for meeting the requirements of a major as stated in the bulletin for the year in which they matriculated in Trinity College although students have the option of meeting requirements in the major changed subsequent to the students' matriculation. A student who completes requirements for two majors may have both recorded on the official record. See the chapter "Academic Procedures and Information" for the majors within each degree and for procedures on declaring a major.

Departmental Major. The courses for a departmental major may include introductory or basic prerequisite courses and higher-level courses in the major department or in the major department and related departments. The courses required in the major department must include at least five beyond the introductory or basic prerequisite level, but these required courses may not exceed eight semester-course credits for the Bachelor of Arts degree or ten for the Bachelor of Science degree. Furthermore, the total number of courses required at any level in the major and related departments may not exceed seventeen semester courses for the Bachelor of Arts degree and nineteen semester courses for the Bachelor of Science degree. Students may elect to take more courses in their major than are required, but only thirteen courses in one (the major) department count toward the graduation requirement of thirty-four semester courses. Departmental majors are available in art design, art history, biological anthropology and anatomy, chemistry, classical languages, classical studies, computer science, cultural anthropology, economics, English, French, geology, Germanic languages and literature, history, Italian studies, mathematics, music, philosophy, physics, political science, psychology, public policy studies, religion, Slavic languages and literatures, sociology, and Spanish. The courses required for a major are specified by the department. The requirements appear in the section following each department's course descriptions.

Program Major. Students may satisfy the requirement by completing work prescribed for a major in approved programs, often interdisciplinary. These programs

include African and Afro-American studies, biology, Canadian studies, comparative area studies, drama, environmental science and policy, literature, and medieval and Renaissance studies. The requirements for these majors appear under each program in the chapter "Courses of Instruction."

Interdepartmental Concentration. A student may pursue an interdepartmental major program designed by the student and advisors as an alternate means of satisfying the major requirement. An interdepartmental concentration consists of at least three courses beyond the introductory level in each of two or more Trinity College departments. For procedures see the section on declaration of major or division in the chapter "Academic Procedures and Information."

Small Group Learning Experiences. By supplementing the classroom and lecture methods of instruction, small group learning experience courses assure students opportunities to engage in discussion, develop skills, refine judgment, and defend ideas when challenged. A *seminar* (ordinarily indicated by the suffix *S*) is an independent course of twelve to fifteen (exceptionally to twenty) students who, together with an instructor, engage in disciplined discussion. The number of meeting hours per term is the same as for regular courses of equivalent credit. Instructors are encouraged to present to each student at the end of the term a written evaluation of the student's work. A *discussion section* (*D*) is a group of fifteen students (exceptionally to twenty) and an instructor, in which discussion is the paramount characteristic; it is an integral part of a larger regular course, and every member of the class is enrolled. A *preceptorial* (*P*) is a group of usually no more than twelve students and an instructor in which discussion is the primary component; it is an additional and optional unit attached to a regular course involving one or more extra meetings per week. No additional course credit is given for a preceptorial. A *tutorial* (*T*) is a group of one to five students and an instructor meeting for discussion which is independent of any other course. For *independent study* students pursue their own interests in reading, research, or writing, but meet with an instructor for guidance and discussion. See the section on independent study in the chapter "Academic Procedures and Information." Instructors in all courses that satisfy the requirements for small group learning experiences, including independent study, must meet with the students at least once every two weeks. The requirements for small group learning experiences are listed under Program I, above. Preceptorials, discussion sections, seminars, and tutorials may not be taken on the pass/fail basis, unless the course is offered only on that basis.

Course Requirements. Thirty-four semester courses are required for graduation, including a maximum of two courses passed with a grade of *D*. At least seventeen courses, including the work of the senior year, must be passed at Duke. Twelve courses must be at the advanced (100-200) level. The thirty-four course credits may include (1) no more than thirteen courses in one department; (2) no more than seventeen total for a major (including those required in related departments) under the Bachelor of Arts degree and no more than nineteen total for a major (including those required in related departments) under the Bachelor of Science degree; (3) no more than one semester-course credit in physical education activity courses; (4) no more than four semester-course credits in dance/American Dance Festival technique/performance courses (i.e., a total of eight half-credit courses); (5) no more than two credits for house courses; (6) no more than six credits for courses taken in professional schools; and (7) no more than four semester-course credits in military science. Certain military science courses listed as carrying credit do not count toward graduation but appear on a student's permanent academic record. Military science courses, like professional school and all physical education courses, do not satisfy general studies (area of knowledge) requirements. (American Dance Festival courses are included in the total limitation on dance technique/performance courses as noted above in this paragraph.)

Residence. A residence period of eight semesters is the typical amount of time a student may take to earn either the Bachelor of Arts or the Bachelor of Science degree. This period may be extended for one or two semesters by a student's academic dean for legitimate reasons, if it seems probable that an extension will enable the student to complete all remaining requirements for graduation. A student will not be permitted residence of more than ten semesters in order to be graduated.

For the minimum residence period, at least seventeen courses must be satisfactorily completed at Duke, including the courses needed to meet the senior year residence requirement. (For the purposes of the residence requirement, advanced placement credits are not considered as courses taken at Duke.) If only seventeen courses are taken at Duke, they must include the student's last eight courses. A student with more than seventeen courses at Duke may take two of the last eight courses at another approved institution. A student who has completed twenty-six courses at Duke may take four of the last eight courses at another approved institution. Courses taken elsewhere must be approved in advance by the appropriate Director of Undergraduate Studies and the student's academic dean.

Former students of Trinity College or the Woman's College who have been out of college for at least six years, and left in good standing, may, with certain provisos, take up to eight semester-courses in another institution of approved standing in final fulfillment of graduation requirements. Further information can be obtained from the Associate Dean of Trinity College of Arts and Sciences responsible for coordinating readmission.

Quality of Work (Continuation Requirements). A student must achieve a satisfactory record of academic performance each term and make satisfactory progress toward graduation each year to continue enrollment in college. A student who fails to meet the minimum requirements described below must leave college for at least two semesters; a summer session may be counted as a semester. The student may apply to Trinity College of Arts and Sciences for readmission. If, after readmission, the student again fails to meet continuation requirements, the student will be ineligible, except in extraordinary instances, for readmission to Trinity College. Students admitted to degree programs from Continuing Education should consult their academic deans concerning continuation requirements.

Satisfactory Performance Each Term. A student who does not receive a passing grade in all courses must meet the following minimum requirements or be withdrawn from the college.

In the Fall or Spring Semester: (1) in the first semester of enrollment at Duke, a student with a normal course load (of at least four semester courses, as defined in the chapter "Academic Procedures and Information") may not fail more than two full courses; (2) after the first semester at Duke, a student with four or more courses may not fail more than one full course; (3) a first-semester student, whether a freshman or a transfer student, who for a special reason has received permission from an academic dean to enroll in fewer than four courses may not fail more than one full course; (4) a student taking an authorized underload after the first semester at Duke must earn all passing grades. (Students may not carry an underload without the permission of their academic dean.) For the purposes of continuation, incomplete work in any course is considered a failure to achieve satisfactory performance in that course. Therefore, where continuation is in question, incomplete work in any course must be completed with a passing grade in time for final grades to be submitted to the Office of the Registrar no later than the weekday preceding the first day of classes of the spring semester, or prior to the first day of classes of the second term of the summer session, as appropriate. In the case of incomplete work in the spring semester, this requirement applies whether or not the student plans to attend one or more terms of the summer session. The student, however, may not enroll in a summer term at Duke unless the requirement of satisfactory performance each semester has been satisfied.

In the Summer Session: to maintain enrollment at Duke a student may not fail more than one full course in a summer term or a summer session. For purposes of continuation, incomplete work is considered failure to achieve a satisfactory performance in that course. Therefore, when eligibility to continue from the summer session to the fall is in question, incomplete courses must be satisfactorily completed in time for a passing grade to be submitted to the Office of the Registrar no later than the weekday preceding the first day of fall classes. Moreover, no student may enter the fall semester with more than one incomplete grade from the preceding spring and summer.

Any student excluded from the college under the provisions of these regulations may on request have the case reviewed by the Senior Associate Dean of Trinity College of Arts and Sciences.

Satisfactory Progress toward Graduation. Each year prior to the beginning of fall term classes, a student must have made satisfactory progress toward fulfillment of curricular requirements to be eligible to continue in the college; i.e., a certain number of courses must have been passed at Duke according to the following schedule:

To be eligible to continue to the	A student must have passed at Duke
2nd semester at Duke	2 semester courses
3rd semester at Duke	6 semester courses
4th semester at Duke	10 semester courses
5th semester at Duke	14 semester courses
6th semester at Duke	19 semester courses
7th semester at Duke	24 semester courses
8th semester at Duke	28 semester courses

For students who have interrupted their university studies, the continuation requirement must still be satisfied before the beginning of each fall term. For such students, the number of courses needed to satisfy the continuation requirement is determined from the table above, based on which semester they will enter in the fall term.

Courses taken in the summer term at Duke may be used to meet this requirement; advanced placement may not be used to satisfy it. No more than two courses completed with D grades may be counted toward fulfilling this annual continuation requirement.

PROGRAM II

Nature and Purpose. Program II is an alternate approach leading to either the Bachelor of Arts or the Bachelor of Science degree. It offers the student who has an unusual interest or talent in a single field, or an unusual combination of interests or talents in several fields, an opportunity to plan and carry out a special curriculum adapted to these interests and needs. Students, with the assistance of a departmental Program II advisor, design an individual plan of study for the whole or the remainder of their college career. Advisor and student together assess the student's background, needs, and goals and evaluate the resources at the University or outside it as means of satisfying those goals. They consider what academic courses would be useful and also take into account that a term of independent study or work/study on or off campus, or a period of study abroad, might be appropriate. Each curriculum is tailored to the special interests and talents of the student for whom it is designed. Among the many topics for Program II have been American studies, primatology, dramatic literacy, linguistics, mariculture, modern thought, mass communications, Arabic studies, and bioethics.

Admission. Students interested in Program II should confer with the Directors of Undergraduate Studies in the departments closest to their interests, with the dean responsible for Program II, and with the Chair of the Committee on Program II, whose name may be obtained from 04 Allen Building. If the student seems eligible for Program II, the Director or other departmental advisor, or an interdepartmental committee, will

counsel the student concerning the design of the curriculum. When an interdepartmental committee is needed, one department will bear administrative responsibility. The curriculum must be approved by the department and also by the Committee on Program II of the Undergraduate Faculty Council of Arts and Sciences. Upon endorsement by that committee, the program becomes an obligation assumed by the student although it may be modified later with the approval of the department and the Committee on Program II. Each semester the student's progress in achieving the plan is reviewed by the dean responsible for Program II.

Until formally accepted into Program II, a student should register for courses to satisfy the curricular requirements of Program I. Should Program II be dropped for any reason, the student assumes all requirements of Program I. Ordinarily, students will be accepted into Program II only after their first semester at Duke; they are ineligible to apply for admission to Program II after their junior year. Further information about Program II may be obtained from the office of the academic dean responsible for Program II, in 04 Allen Building.

General Requirements. Apart from the requirements arising from the approved plan of work, a Program II student must satisfy certain general requirements: thirty-four semester-course credits for graduation; breadth requirements; the regulations on military science, house, professional school, and physical activity and dance courses; and residence, although the requirements relating to the last eight courses may be adjusted to suit the student's approved plan of work. Graduation with distinction and Latin honors by honors project are available for qualified students in Program II. See the section on honors in the chapter "Academic Procedures and Information."

COMBINATION PROGRAMS OF TRINITY COLLEGE AND DUKE PROFESSIONAL SCHOOLS

A student interested in attending a Duke professional school (business, environment, and law) may, upon meeting certain requirements, combine the senior year in Trinity College of Arts and Sciences with the first year in the professional school. To qualify the student must (1) successfully complete twenty-six semester courses in Trinity College; (2) fulfill all other degree requirements in Trinity College except for eight elective courses; (3) obtain the approval of the appropriate preprofessional advisor and academic dean in Trinity College; and (4) be admitted to the professional school. If the student's application to the professional school is accepted, the student transfers to the professional school for the fourth year and begins work on the professional degree. Upon successful completion of the work in the first year of the professional school, the baccalaureate degree is awarded to the student. The undergraduate record notes the student's enrollment in the combination program, the name of the professional school, the date of graduation from Trinity College, and the degree awarded, but it does not include courses taken in the professional school. Counseling and additional information are available from the preprofessional advisors.

PREPARATION FOR GRADUATE AND PROFESSIONAL SCHOOLS

Students planning to enter a graduate or professional school should consult their faculty advisors, Director of Undergraduate Studies, or academic dean at the earliest opportunity. Since many graduate and professional schools require special tests for students seeking admission, information regarding requirements should also be obtained from the catalogs of the appropriate schools. The Office of Counseling and Psychological Services will provide applications for the testing programs.

Graduate Schools of Arts and Sciences. Students interested in obtaining a master of science, master of arts, or doctor of philosophy degree should discuss their plans as early as possible with faculty in the proposed field of advanced study. As undergraduates, they should become involved in research which may involve laboratory work,

advanced seminars, or independent study. Many graduate schools require a reading knowledge of a foreign language. Information on this and other requirements is available in the bulletins of specific graduate programs and in the Directory of Graduate Programs published by the GRE board and Council of Graduate Schools. It may also be included in the "Handbook for Majors" for the major department. A research mentor, a faculty advisor, and the Ph.D. advisor in the major department are the best resources for advice about graduate school in the arts and sciences. General advice may be sought from the advisor for pre-graduate study, 04 Allen Building.

Graduate Schools of Engineering. Students interested in graduate work in engineering should consult the Dean of the School of Engineering or the Director of Graduate Studies in one of the engineering departments. Most engineering graduate schools require that a candidate have the equivalent of a Bachelor of Science in Engineering degree; however, students in the natural and social sciences may obtain conditional admission if they have a sufficient background in mathematics.

Graduate Schools of Business. Students seeking information about graduate schools of business should consult the advisor in Trinity College. In preparing for graduate business school, students should gain a good liberal arts background, choosing courses that will help them develop communication skills, analytical skills, and an understanding of human nature. Students have often chosen such courses as Computer Science 10, Economics 1D and 2D (or 51 and 52), Management Sciences 53, and Mathematics 31 as those which develop analytical skills. For further information concerning undergraduate preparation, see the *Prebusiness Handbook for Duke Seniors and Alumni* and *The Official Guide to MBA Programs*, published by the Graduate Management Admission Council; these publications and other resource materials are available in the Prebusiness Advising Office, 03 Allen Building.

Medical and Dental Schools. Students planning to enter schools of medicine and dentistry can prepare for admission by completing any of the regular departmental majors in Program I or by completing Program II, and by taking those courses required by the professional schools of their choice. Virtually all medical schools and most schools of dentistry require the same basic group of college premedical courses—a year of biology, a year each of inorganic and organic chemistry, and a year of general physics. In addition, many schools require a year of English and courses in the humanities or social sciences. About a third of all medical schools require a year of college mathematics and some specify calculus, statistics, or computer science. For a complete listing of these and any additional course requirements set by each school, consult *Medical School Admissions Requirements*, published by the Association of American Medical Colleges or *Admission Requirements of U.S. and Canadian Dental Schools*, published by the American Association of Dental Schools. These and similar resources for schools of optometry and veterinary medicine are located in the Health Professions Advising Office. Students should discuss their programs of study with their major advisors, academic deans, and with the advisor for the health professions.

Graduate Programs in the Health Professions. Students interested in careers as physical therapists, health administrators, or others of the allied health professions should prepare with course work in the natural sciences and behavioral sciences within a liberal arts curriculum. Descriptive literature on each of the allied health schools and professions is part of the library maintained in the Health Professions Advising Office. Students will also find publications of selected advanced degree programs in biomedical research, including the combined M.D./Ph.D. degree programs.

Law Schools. Students who plan to prepare for law school and a career in law should seek breadth in their undergraduate course program with specialization in one or more areas. They may choose virtually any field for their major work. Though no specific courses are required, prelaw students have often chosen from among the

following: Management Sciences 53; Economics 1D, 2D; English 117S; History 21D, 22D, 91D, 91S, 92, 92D, 92S, 241-242; Philosophy 48; Political Science 91D, 127, 207S; Public Policy Studies 55D; Sociology 10D and 157.

For a fuller discussion of undergraduate preparation for the study of law, students should refer to the *Duke Prelaw Handbook* or the *Prelaw Handbook* published by the Association of American Law Schools and the Law School Admission Council, or consult the prelaw advisor in the college.

Theological Schools and Religious Work. Students contemplating theological study should correspond at the earliest opportunity with the appropriate schools and with the authorities of their respective judicatories to learn how to prepare for the specific programs they expect to enter. They should consider the following subjects: English language and literature; history, including non-Western cultures as well as European and American; philosophy, particularly its history and its methods; natural sciences, both the physical and the life sciences; psychology, sociology, and anthropology; the fine arts and music; biblical and modern languages; religion, both in the Judaeo-Christian and in the Near and Far Eastern traditions. Some seminaries require Greek or Hebrew for admission. It is the understanding gained in these fields rather than the total number of credits or semester hours earned that is significant. More detailed information about theological education, not limited to Duke, may be obtained from the Director of Admissions of the Divinity School.

The School of Engineering

Duke University offers in the School of Engineering programs of study which lead to the degree of Bachelor of Science in Engineering. Four programs are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). These programs are biomedical engineering, civil engineering, electrical engineering, and mechanical engineering. These accredited programs, and special programs of study in interdisciplinary fields, are offered by the Departments of Biomedical Engineering, Civil and Environmental Engineering, Electrical Engineering, and Mechanical Engineering and Materials Science.

For graduation with a Bachelor of Science in Engineering degree, a student must complete successfully a minimum of thirty-four semester courses. These thirty-four semester courses must include the following:

General Requirements*

Writing	1 s.c.	This requirement is met by completing a University Writing Course.
Mathematics	4 s.c.	This requirement is met by completing Mathematics 31, 32, and 103; plus 104 or 111 or 135.†
Natural Science	4 s.c.	This requirement is met by completing Chemistry 11L, Physics 51L and 52L, and an elective course in one of the natural science departments which presents fundamental knowledge about nature and its phenomena, preferably including quantitative expression.‡§

*No more than 1 s.c. credit in physical education activity and 1 s.c. credit in music activity can be used to meet Bachelor of Science in Engineering degree requirements. House courses may not be used to meet BSE degree requirements.

†A minimum of 9 s.c. credits in mathematics, natural science, and statistics are required.

§Physics 53L and 54L may be substituted for Physics 51L and 52L. Courses in mathematics, statistics, and computer science will not meet the elective requirement. A list of disallowed courses is maintained in the Dean's office.

Humanities and
Social Sciences 5 s.c.

This requirement is met by completion of five courses selected from at least three of the following four areas of knowledge: Arts and Literatures (AL), Civilizations (CZ), Foreign Languages (FL), and Social Sciences (SS). At least one course must be classified SS. In order to provide depth in the subject matter, at least two of the five courses must be selected from a single department and at least one of those courses must be 100-level or above. This program of courses should reflect a thematic coherence and fulfill an objective appropriate to the engineering profession. Courses selected must be those which present essential subject matter and substance of the discipline; for example, no introductory skill courses may be used to satisfy this requirement. Likewise, courses devoted primarily to subjects such as accounting, management science, industrial management, finance, personnel administration, introductory language, and ROTC do not fulfill this objective regardless of their general value in the total engineering curriculum. Courses taught in professional schools may not be used to satisfy this requirement.

Engineering and
Applied Sciences 4 s.c.

This requirement is met by completion of one course from each of four of the following six areas: electrical science, information and computer science, mechanics (solid and fluid), materials science, systems analysis, and thermal science and transfer processes. See departmental requirements, which follow, for any specific courses to be included

Digital Computation

Students are expected to have acquired digital-computer programming capability before their sophomore year. The programming capability may be satisfied by Advanced Placement or by passing Engineering 53L or Computer Science 52 or 53.

Departmental Requirements

Departmental
Specifications 16 s.c.

The department administering the major field of study will specify this requirement. In general, it will consist of both required courses and electives to be planned in consultation with the departmental advisor. Including the 4 s.c. in engineering and applied sciences listed under general requirements, a total of 13.0 s.c. in engineering work including 8.5 s.c. equivalents in engineering science and 4.25 s.c. equivalents in engineering design are required. See the individual departmental requirements, which follow.

*Total Minimum
Requirement 34 s.c.

*A maximum of two semester courses of junior or senior level air science, military science, or naval science course work may be counted in satisfying the minimum requirements of thirty-four semester courses for a baccalaureate degree in engineering. These courses must be included in the sixteen semester courses listed under departmental requirements. All other courses completed in air, military, or naval science are taken in addition to the minimum program.

Biomedical Engineering Departmental Requirements

All general requirements and departmental requirements comprising the accredited biomedical engineering major are incorporated in the following sequence, only one of several possible sequences. The student is encouraged to choose electives and select a sequence which develops broad intellectual interests.

Freshman Year

First Semester	Courses	Second Semester	Courses
Chemistry 11L	1	Chemistry 12L	1
University Writing Course	1	Physics 51L	1
Mathematics 31	1	Mathematics 32	1
Engineering 53L or Social Science or Humanities Elective	1	Social Science or Humanities Elective or Engineering 53L	1
	4		4

Sophomore Year

First Semester	Courses	Second Semester	Courses
Physics 52L	1	Biomedical Engineering 163.....	1
Electrical Engineering 61	1	Elective	1
Mathematics 103	1	Mathematics 111	1
*Biomedical Engineering 83 or Engineering 83	1	Social Science or Humanities Elective	1
Elective	1	Life Science Elective	1
	5		5

Junior Year

First Semester	Courses	Second Semester	Courses
Biomedical Engineering 110 or Engineering 75L.....	1	Biomedical Engineering 145 or Mechanical Engineering 101L	1
Electrical Engineering 64 or Biomedical Engineering 171	1	Life Science Elective	1
Statistics 113	1	Biomedical Engineering 164	1
Social Science or Humanities Elective	1	Mathematics 114	1
	4		4

Senior Year

First Semester	Courses	Second Semester	Courses
Biomedical Engineering 207	1	Biomedical Engineering Elective	1
Biomedical Engineering 101.....	1	Biomedical Engineering Elective	1
Biomedical Engineering Elective	1	Social Science or Humanities Elective	1
Biomedical Engineering Elective	1	Social Science or Humanities Elective	1
	4		4

Students preparing for medical school should schedule Chemistry 151L and 152L, and two life science electives before the end of their junior year by deferring some required courses to the senior year. Biomedical engineering electives include all courses with biomedical engineering numbers other than required courses. Mechanical Engineering 126 may be taken also as a biomedical engineering elective.

*Biomedical Engineering 83 is not required for students who complete a second major in electrical engineering.

Civil And Environmental Engineering Departmental Requirements

The general requirements and departmental requirements comprising the accredited civil engineering major are all incorporated in the following typical sequence of courses. This sequence is only one of several possible sequences and students are encouraged to work closely with their advisor in choosing electives and selecting a sequence of courses to develop their individual interests.

Freshman Year

First Semester	Courses	Second Semester	Courses
Chemistry 11L	1	Engineering 24 L or Engineering 25L	1
Mathematics 31	1	Mathematics 32	1
Engineering 53L or Elective	1	Elective or Engineering 53L	1
University Writing Course	1	Physics 51L	1
	<u>4</u>		<u>4</u>

Sophomore Year

First Semester	Courses	Second Semester	Courses
Engineering 75L	1	Engineering 123L	1
Mathematics 103	1	Mathematics 111	1
Physics 52L	1	Engineering 25L or Engineering 24L	1
Elective	1	Elective	1
	<u>4</u>		<u>4</u>

Junior Year

First Semester	Courses	Second Semester	Courses
Civil Engineering 122L	1	Engineering 115.....	1
Civil Engineering 131L	1	Engineering 150L.....	1
Statistics 113	1	Elective	1
Elective	1	Elective	1
Elective	1	Elective	1
	<u>5</u>		<u>5</u>

Senior Year

First Semester	Courses	Second Semester	Courses
Elective	1	Civil Engineering 192.....	1
Elective	1	Elective	1
Elective	1	Elective	1
Elective	1	Elective	1
	<u>4</u>		<u>4</u>

The program of electives shall include: at least one of Electrical Engineering 61L, Engineering 83L, or Mechanical Engineering 101L or Biomedical Engineering 145; at least five courses in humanities and social sciences; at least one course in the natural sciences; at least two courses chosen from Civil Engineering 116, 123L, and 139L; at least two 200-level civil engineering courses. Any higher level environmental engineering course may be substituted for Engineering 24L and/or any higher level structures course may be substituted for Engineering 25L.

Electrical Engineering Departmental Requirements

The general requirements and departmental requirements comprising the accredited electrical engineering major are all incorporated in the following program. This program is presented as a guide to assist students in planning their four-year program and should not be viewed as an inflexible sequencing of courses.

Freshman Year

First Semester	Courses	Second Semester	Courses
Mathematics 31	1	Mathematics 32	1
Chemistry 11L	1	Physics 51L	1
University Writing Course	1	Approved Elective.....	1
Computer Science 52 or 53 or Engineering 53L or Social Science-Humanities Elective...1	1	Computer Science 52 or 53 or Engineering 53L or Social Science-Humanities Elective...1	1
	<u>4</u>		<u>4</u>

Sophomore Year

First Semester	Courses	Second Semester	Courses
Mathematics 103	1	†Mathematics 1A	1
Electrical Engineering 61	1	Electrical Engineering 62	1
Physics 52L	1	Electrical Engineering 64	1
Social Science-Humanities Elective	1	Social Science-Humanities Elective	1
	<u>4</u>	Approved Elective	1
			<u>5</u>

Junior Year

First Semester	Courses	Second Semester	Courses
†Mathematics 1B	1	†Mathematics 1C	1
*Electrical Engineering 1A	1	Electrical Engineering 170	1
Electrical Engineering 63	1	*Electrical Engineering 1B	1
Social Science-Humanities Elective	1	Social Science-Humanities Elective	1
	<u>4</u>	§Natural Science Elective	1
			<u>5</u>

Senior Year

First Semester	Courses	Second Semester	Courses
*Electrical Engineering 2A	1	Electrical Engineering Elective	1
Electrical Engineering Elective	1	*Electrical Engineering 2B	1
†Engineering Elective	1	Approved Elective	1
Approved Elective	1	Approved Elective	1
	<u>4</u>		<u>4</u>

Note: The selection of approved electives should take into account a departmental requirement that a student must have accumulated by graduation time the equivalent of 13.0 engineering courses including 4.25 engineering design and 8.5 engineering science courses. This engineering design requirement must include a course which is more than 0.5 ED and must be taken in the junior or senior year of the program. This course must have as a prerequisite at least one course in the discipline. Engineering 23, Engineering 174, and Engineering 175 may not be counted toward the departmental requirement.

In order to satisfy the School of Engineering distributional requirement of four courses in engineering and applied science, the student may use Electrical Engineering 61 as an electrical science course and Electrical Engineering 64 as a systems analysis course. The remaining two courses may be selected from any two of the following areas: information and computer science (Engineering 53L or Computer Science 52 or 53 may be used to satisfy this requirement), mechanics, materials science, and thermal sciences.

An up-to-date list of acceptable engineering design and engineering science courses may be obtained from the departmental office.

*To be selected from two of the following areas: computer engineering; signal processing and communications; solid state electronics and circuits; systems and robotics; electromagnetic fields and optics; power electronics.

†Students interested in computer engineering, signal processing and communications, systems and robotics, or power electronics should select Mathematics 104, 131, and 135 or Statistics 113. Students interested in solid state electronics and circuits or electromagnetic fields and optics should select Mathematics 111, 114, and 135 or Statistics 113.

‡To be selected from: mechanics (Engineering 75L or 123L, Mechanical Engineering 126L, or Biomedical Engineering 110); thermal sciences (Mechanical Engineering 101L, Electrical Engineering 176, Mechanical Engineering 150L, or Biomedical Engineering 145 or 202); or materials science (Engineering 83L or Biomedical Engineering 215).

§The following courses are recommended: Chemistry 12L; Physics 100, 105, 176, 181, and 185; Biology 21L.

Mechanical Engineering and Materials Science Departmental Requirements

The general requirements and departmental requirements comprising the accredited mechanical engineering major are all incorporated in the following program. This sequence of the courses is presented as an overview of the program and is one of two recommended sequences of the course requirements.

Freshman Year

First Semester	Courses	Second Semester	Courses
Mathematics 31	1	Mathematics 32	1
Chemistry 11L	1	Physics 51L	1
University Writing Course	1	Engineering 83L	1
Engineering 53L or Elective	1	*Elective or Engineering 53L	1
	<u>4</u>		<u>4</u>

Sophomore Year

First Semester	Courses	Second Semester	Courses
Mathematics 103	1	Mathematics 111	1
Physics 52L	1	Mechanical Engineering 101L	1
Engineering 75L	1	Engineering 123L	1
*Elective	1	*Elective	1
*Elective	1	*Elective	1
	<u>5</u>		<u>5</u>

Junior Year

First Semester	Courses	Second Semester	Courses
Mechanical Engineering 130L	1	Mechanical Engineering 141L	1
Mechanical Engineering 120L	1	Mechanical Engineering 150L	1
Mechanical Engineering 126L	1	Mathematics 114	1
Mechanical Engineering 115L	1	Physics 171L	1
	<u>4</u>		<u>4</u>

Senior Year

First Semester	Courses	Second Semester	Courses
Mechanical Engineering 160	1	Mechanical Engineering Elective	1
Mechanical Engineering Elective	1	†Technical Elective	1
†Technical Elective	1	*Elective	1
*Elective	1	*Elective	1
	<u>4</u>		<u>4</u>

*Part of a program of approved electives planned with the student's faculty advisor to suit individual interests and abilities.

†One of two electives restricted to the areas of engineering, mathematics, or natural sciences. A list of disallowed courses is maintained in the departmental office. The program must include five social science-humanities courses selected to meet the general requirements of the School of Engineering.

Declaration of Major. A student is urged to declare a major by the time of registration for the first semester of the sophomore year, but is required to do so by the time of registration for the first semester of the junior year. Declaration of major is accomplished by completing a form available in the Office of the Dean of Engineering.

Double Major. If an engineering student completes simultaneously the requirements for a departmental major in arts and sciences and the requirements for a Bachelor of Science in Engineering degree, or satisfies simultaneously the requirements for two engineering majors, the official record will indicate this fact. However, the Director of Undergraduate Studies for the second major must certify that the departmental major requirements have been met. The student must initiate the procedure, either through the Dean of the School of Engineering or through the Director of Undergraduate Studies in the second department. The completion of the requirements for the major in this department must be confirmed no later than the time of registration for the final

semester. Courses which are common to both majors shall be counted toward satisfying the requirements of both majors.

Interdisciplinary Programs in Engineering. These programs parallel the major programs in biomedical, civil, electrical, and mechanical engineering, but are not individually accredited by ABET. They provide special opportunities for study in interdisciplinary fields, such as energy conversion, biochemical engineering, engineering mechanics, materials science, pollution control, systems and controls, and urban engineering, leading to the Bachelor of Science in Engineering degree, which may be arranged with approval of the engineering faculty. Any student, in consultation with the advisor or another faculty member, may propose a unique combination of courses designed to meet particular career objectives. The proposal should be submitted to the Engineering Faculty Council, through the Dean of the School of Engineering, for approval; it may be submitted as early as the second semester of the freshman year and must be submitted before the beginning of the senior year. The proposal should include the student's reasons for pursuing the suggested program of study, and it must show how the proposed courses satisfy the following requirements:

1. The proposed program of study meets the general requirements for the Bachelor of Science in Engineering degree but cannot be accommodated by the approved departmental requirements in biomedical, civil, electrical, or mechanical engineering.
2. A program of at least nine engineering courses is included to provide depth in the chosen interdisciplinary area of study.
3. A program of at least five courses, in addition to the seventeen courses listed under general requirements, is included to provide breadth in technical areas (engineering, natural science, and mathematics).
4. The remaining courses, which are treated as electives, require the approval of the student's advisor.

Each student enrolled in an approved interdisciplinary program will be assigned to the appropriate engineering department for administrative purposes.

International Honors Program This program consists of 40 semester courses: 6 semester courses beyond the basic accredited programs in addition to one semester of study abroad or two summers of study abroad. Some of the required distributional electives in Comparative Area Studies and foreign language will satisfy the humanities and social sciences requirement of the basic accredited programs. Specific program requirements and an application may be obtained in the Office of the Dean of Engineering.

Bachelor of Science in Engineering/Master of Science Program. This program provides students with an opportunity to plan a coordinated five-year program of studies in the School of Engineering leading to both the Bachelor of Science in Engineering and Master of Science degrees. Application for admission to this integrated program may be made during the junior or senior year. Provisional admission to the Graduate School may be granted when the student enrolls for the semester during which the Bachelor of Science in Engineering degree requirements will be completed. Graduate level courses during this period which are in excess of Bachelor of Science in Engineering requirements may be credited toward fulfillment of the Master of Science degree requirements.

Students must complete thirty semester hours of credit specifically approved for the Master of Science degree under the prevailing graduate rules; up to six of these hours may be thesis research if the program includes a written master's thesis. No more than nine semester hours of graduate work can be completed concurrently with completing the Bachelor of Science in Engineering degree requirements.

Bachelor of Science in Engineering/Master of Business Administration. This program provides students with an opportunity to plan a coordinated five-year program of studies leading to the Bachelor of Science in Engineering and Master of Business Administration degrees. Joint degree students are enrolled in the School of Engineering for three years and in the Fuqua School of Business for two years. Typically, four engineering courses taking during the fifth year fulfill requirements for both degrees.

Residence Requirements. At least seventeen semester courses must be completed satisfactorily at Duke. This must include the work of the final two semesters, with the following exceptions: the student who has completed more than four full semesters of work at Duke may take the last two courses elsewhere; others may take the last course elsewhere. The courses taken elsewhere must be approved in advance by the student's major advisor and academic dean.

Pass/Fail Grading Option. With the consent of the instructor and the faculty advisor, an engineering student may choose to be graded on a pass/fail basis in up to four unrestricted electives or social sciences-humanities electives within the thirty-four-course program. A student may take no more than one course on a pass/fail basis each semester.



Repetition of Courses. An engineering student who has earned a grade of *D-*, *D*, or *D+* in a required mathematics course or a required engineering course may, with permission of his or her advisor, Director of Undergraduate Studies, and academic dean, repeat the course. Both grades will remain on the student's record. Only one credit may be counted toward satisfying continuation requirements and toward fulfilling graduation requirements.

Annual Recognition. In acknowledgment of high academic achievement, recognition is given each summer to freshmen, sophomores, juniors, and seniors if the following requirements are met:

1. A normal academic load has been carried in the fall and spring terms.
2. Grades other than *P* have been earned in six semester courses.
3. No incomplete or failing grade has been received during the fall and spring terms.

The Dean's List recognizes students who earn a 3.3 average on all work in both the fall and spring terms. The Dean's List with Distinction includes students who earn a 3.6 on all work in both the fall and spring terms of an academic year.

Continuation Requirements. A student must achieve a satisfactory record of academic performance each semester and make satisfactory progress toward graduation to remain enrolled in the University.

A student must pass at least three courses in each semester, except for the first semester of the freshman year, in which at least two courses must be passed. A student who fails to meet this continuation requirement must leave the University for at least two semesters. A complete summer session may be counted as a semester. Following application for readmission, return must be approved by the Dean and the Director of Undergraduate Studies in the student's major department. If the student thereafter fails to pass three courses in a semester, permanent dismissal from the University usually results. A student who enrolls in more than four courses in a given semester and fails two or more of them will not be permitted to enroll for more than four courses in the following semester without approval of the Dean. In addition, a student may be dismissed temporarily or permanently for failing to make satisfactory progress toward graduation, including satisfactory progress toward fulfillment of curricular requirements within ten semesters.

The term satisfactory progress shall be defined also by the following schedule:

1. To begin enrollment in the second year, a student must have passed 6 s.c. at Duke and earned *P*, *C-*, or better in 4 s.c.
2. To begin enrollment in the third year, a student must have passed 13 s.c. at Duke and earned *P*, *C-*, or better in 11 s.c.
3. To begin enrollment in the fourth year, a student must have passed 20 s.c. at Duke and earned *P*, *C-*, or better in 18 s.c.
4. To begin enrollment in the fifth year, a student must have passed 27 s.c. at Duke and earned *P*, *C-*, or better in 25 s.c.

Grade Requirement for Graduation. Of the thirty-four semester courses which fulfill the specified categories in the Bachelor of Science in Engineering degree requirements, thirty-two or their equivalent in number must be passed with grades of *P*, *C-*, or better.

Academic Procedures and Information



Advanced Placement

Scores on the tests discussed below and documented previous educational experience are the criteria used to determine a student's qualifications for certain advanced courses. If questions arise, students should consult the Director of Undergraduate Studies in the appropriate department or the University Registrar.

College Board Advanced Placement Program (APP) Examinations. A score of 4 or 5 on College Board Advanced Placement Program Examinations, taken prior to matriculation in college, is the basis for consideration for credit and/or placement in advanced courses in art, biology, chemistry, computer science, economics, English,* French, German, history, Latin, music, physics,** political science, and Spanish. The Department of Mathematics will consider a score of 3 for placement beyond the introductory course. The record of a student presenting such a score and desiring to continue in the same subject at Duke will be evaluated for credit and for placement in an advanced course. Departmental policies regarding advanced placement and credit may vary. In the case of French, German, Latin, and Spanish, APP scores of 4 or 5 may result in placement in courses at the 100 level; approval of the Director of Undergraduate Studies or Supervisor of Freshman Instruction in the appropriate department is required before final placement is made. Credit may be granted for one or two courses in each subject area, with the approval of the academic department concerned. Scores should be submitted to the Office of the Registrar no later than the end of the sophomore year. Also, see the section on residence requirements in the chapter "Degree Programs."

*The score in English Advanced Placement, although qualifying a student for advanced courses in literature, does not satisfy the requirement in Writing.

**In order to receive credit for Physics 51L or 52L, a student must take a validation test during orientation.

College Board Tests. Scores on College Board Tests are the basic criteria for placement in French, German, Spanish, Latin, and mathematics. Course credit is not given for courses bypassed. The following tables will assist students in making reasonable course selections in the subjects indicated.

	<u>College Board Achievement Score</u>	<u>Placement</u>
French*	200-370	French 1-2
	380-440	French 12
	450-540	French 63
	550-590	French 76
	600 plus	French 100-level course
German	200-400	German 1†
	410-510	German 65-66
	520-590	German 63
	600 plus	Third year‡
Spanish*	200-420	Spanish 1-2
	430-490	Spanish 12
	500-570	Spanish 63
	580-620	Spanish 76
	630 plus	Spanish 100-level course
Latin	200-520	Latin 1
	530-630	Latin 63
	640 plus	Third year‡
Mathematics§	460-540	Math. 19
	550-800	Math. 31L, or with one year of high school calculus, Math. 41

*In these languages students are permitted to drop back one level without loss of credit (e.g., from 101 to 76 or from 76 to 63). No credit will be allowed for courses two levels below the achievement score (e.g., students with a score of 640 in French or Spanish could not receive credit for 63, but could for 76). In no case will credit be given for 1-2 to students with three or more years of high school French or Spanish.

†The first year of a language may *not* be taken for credit by a student who has completed more than two years of that language in secondary school. In rare cases, an exception may be granted with permission of the Director of Undergraduate Studies in the appropriate department.

‡An exception may be granted in consultation with the Director of Undergraduate Studies.

§In the absence of an Achievement Test score, course placement is determined by the SAT score as follows: 600 or below—Math. 19; 610-800—Math. 31L.

Newly admitted students who wish to continue study of French, German, Spanish, or Latin begun in secondary school must take a College Board Achievement Test or College Board Advanced Placement (APP) Examination in that language by June of the senior year in secondary school. Students who plan to take mathematics at Duke are expected to present College Board SAT, Mathematics Achievement (Level I or Level II), or Advanced Placement Program (APP, either level AB or level BC) scores. Placement testing is not offered during New Student Orientation in mathematics or in languages covered by the Achievement Test or Advanced Placement Examination programs of the College Board. New students who wish to continue study in French, German, Spanish, or Latin but who found that it was not possible due to extraordinary circumstances to take the appropriate College Board examinations, may petition to take a placement test at Duke University prior to the beginning of New Student Orientation. Petitions explaining the reason a test was not taken must be received by the Coordinator of Testing, Counseling and Psychological Services, P.O. Box 90955, by July 1. If the petition is granted, a fee will be charged to cover testing costs. Because residence halls are not

open before the beginning of New Student Orientation, students whose petitions are granted will also need to arrange accommodations in the Durham area.

All students who plan to take mathematics during their first semester at Duke, and who do not submit the College Board SAT or Achievement Test or Advanced Placement Program score in mathematics, should consult with the Supervisor of Freshman Instruction in Mathematics during New Student Orientation. New students who have been placed in Mathematics 19 or 31 on the basis of College Board SAT, Achievement, or Advanced Placement Examinations but who believe that their background in mathematics justifies a higher placement, should also confer during New Student Orientation with the Supervisor of Freshman Instruction or with the Director of Undergraduate Studies in the Department of Mathematics.

International Entrance Examinations. Duke University recognizes the International Baccalaureate Program, the French Baccalaureate, the British A-Level Examinations, the Hong Kong A-Level Examinations, the German Abitur and the Swiss Federal Maturity Certificate. Advanced standing credit and/or placement can be awarded upon the recommendation of the concerned Duke department. Scores acceptable for consideration are determined by the faculty and evaluated by the University Registrar.

Placement in Languages Other Than French, German, Spanish, and Latin. Students who wish to continue in any language other than French, German, Spanish, or Latin should consult with the appropriate Director of Undergraduate Studies. In the case of Russian, the department offers an examination which is used in conjunction with other criteria for placing students at the appropriate level.

Reading Out of Introductory Courses. Students demonstrating academic ability may be granted the option of reading out of an introductory or prerequisite course in order to allow them to advance at their own pace to upper-level work. No course credit may be earned by reading out. Reading for a course and auditing are mutually exclusive procedures. Students should consult with the appropriate directors of undergraduate studies who must approve the proposed program of reading. Students may be certified for advanced course work by passing a qualifying examination prepared by the department. When an advanced course is completed, an entry is made on the permanent record that the qualifying examination was passed, but no course credit is awarded.

Transfer of Work Elsewhere

Work Done Prior to Matriculation at Duke. First-year Duke students may submit for evaluation college courses taken after the commencement of the student's junior year of high school. Students transferring from a degree program in another accredited institution may be granted credit for up to seventeen semester-course credits. Ordinarily, students will not be awarded more than four semester-course credits for one semester's work unless they have satisfactorily completed more than the normal course load at the institutions from which they are transferring credit. Courses taken at other institutions prior to matriculation at Duke are evaluated by the University Registrar and the faculty.

Evaluation of Work Taken Elsewhere. Courses in which grades of less than C- have been earned are not accepted for transfer credit; students seeking transfer credit for courses in which they earned a P grade must present official verification that the P is equivalent to at least a C- grade. The semester-course unit of credit awarded at Duke for satisfactorily completed courses cannot be directly equated with semester-hour or quarter-hour credits. Credit equivalency is determined by the University Registrar. All courses approved for transfer are listed on the student's permanent record at Duke, but grades earned are not recorded. Further information is available from the University Registrar.

After matriculation as a full-time degree candidate at Duke University, a student in Trinity College of Arts and Sciences may receive credit toward the Bachelor of Science or Bachelor of Arts degree for two courses taken at another institution in the United States, whether in the summer while regularly enrolled at Duke, while withdrawn voluntarily from the College, or while on leave of absence for personal, medical, or financial reasons. Trinity College students, when eligible, may also receive transfer credit for up to ten courses taken in an approved program for study abroad (see the section on Study Abroad). In some cases, transfer credit may be received for a maximum of four of the final eight courses toward the bachelor's degree (see the section on Residence Requirements). Once matriculated, however, a student may not receive credit for more than a *total* of ten transfer courses toward the Bachelor of Science or Bachelor of Arts degree. Full-time degree candidates in the School of Engineering may receive credit toward the Bachelor of Science in Engineering degree for a maximum of four courses taken at another institution. Ordinarily, no credit will be accepted for course work taken while a student is withdrawn involuntarily. For purposes of this regulation, advanced placement and interinstitutional credit (see the section on agreement with neighboring universities) are not considered as work taken at another institution.

Students may not transfer credit from two-year colleges after completing their sophomore year. At least half the courses submitted toward fulfillment of a student's major field must be taken at Duke, but departments may make exceptions to this rule in special circumstances. No credit is given for work completed by correspondence, and credit for not more than two semester courses is allowed for extension courses.

Approval for Courses Taken Elsewhere. Approval forms for courses to be taken at institutions other than Duke may be obtained from the offices of the academic deans. Students wishing to transfer credit for study at another accredited college while on leave or during the summer must present a catalog of that college to the appropriate dean and Director of Undergraduate Studies and obtain their approval *prior* to taking the courses.

Advising

Students and their advisors confer when necessary, but they should confer at least once before every registration period to review goals, plans for achieving them, and any problems encountered or anticipated. Before declaring a major in Trinity College, students confer with the premajor advisor, the academic dean for premajor students, or the academic dean in the division of their interests. Upon declaring a major, the student is assigned a faculty advisor; the academic dean for that division is also available for consultation. In the School of Engineering, the advisor's signature is necessary for registration and all course changes. Much good advising is informal and occurs in conversation with members of the faculty. Students have the responsibility to understand and meet the requirements for the curriculum under which they are studying and should seek advice as appropriate.

Registration

Students are expected to register at specified times for each successive term. Prior to registration each student receives special instructions and registration materials. Students prepare a course program, and submit it at an appointed time to their advisors for review. In the School of Engineering, the schedule must be approved by the advisor.

Students who expect to obtain certification to teach in secondary schools should consult an advisor in the education program prior to each registration period to ensure that they are meeting requirements for state certification and that they will have places reserved for them in the student teaching program.

Those who register late are subject to a \$50 fine. Students who fail to register for the fall or spring semester are withdrawn and must apply for readmission if they wish to return; they also forfeit their registration deposits unless they indicate at the time of

registration their intention not to continue in the University the following term. Those students who have not paid any fees owed to or fines imposed by the University (such as laboratory fees, library fines, and parking fines) by the date specified for registration for the following term will not be permitted to register for the following term until such fees and fines have been paid in full, notwithstanding the fact that the student may have paid in full the tuition for the following term.

Students planning to register for a course under the reciprocal (interinstitutional) agreement must have the course approved by the appropriate Director of Undergraduate Studies and their academic dean. Further information about registration procedures once approval is given may be obtained from the Office of the Registrar. See the chapter "Special Programs" for information regarding the reciprocal agreement with neighboring universities.

Duke Identification Card and Term Enrollment. Undergraduate students are issued identification cards which they should carry at all times. The card is a means of identification for library privileges, University functions, and services available to University students. Students are expected to present their card on request to any University official or employee. The card is not transferable, and fraudulent use may result in loss of student privileges or suspension. Loss of the card should be reported immediately to the Office of the Registrar where new ones can be obtained for \$5. Official enrollment is required for admission to any class. Failure to report, or to account beforehand for an absence, entails a loss of registration in courses.

Concurrent Enrollment. A student enrolled at Duke may not enroll concurrently in any other school or college without special permission of the appropriate academic dean. See, however, the statement regarding the reciprocal agreement with the University of North Carolina at Chapel Hill, North Carolina Central University in Durham, and North Carolina State University at Raleigh.

Course Changes after Classes Begin in the Fall and Spring Terms. During the drop/add period changes may be made in course schedules.

In Trinity College of Arts and Sciences, students may drop and add courses during the first week of classes in the fall and spring terms at their own discretion; during the second week of the drop/add period they may drop courses at their own discretion, but the approval of the appropriate instructor is required for adding a course. After the drop/add period no course may be added; also, a course may not be changed to or from the pass/fail or audit basis. To withdraw from a course, students must obtain permission from their academic deans, and for reasons of course overload the academic dean may give permission up to midterm. Ordinarily, courses may not be discontinued after midterm. In extraordinary circumstances, however, e.g., for reasons of health, the academic dean may allow a student to withdraw. After the drop/add period, the student receives a WP grade (withdraw passing) or WF (withdraw failing) from the instructor. Course work discontinued without the dean's permission will ordinarily result in a grade of F.

Within the School of Engineering, the approval of the advisor is necessary for dropping or adding courses after classes begin. After the drop/add period no course may be added, and in order to withdraw from a course students must obtain permission from their academic dean. Factors to be considered by the dean include health, necessary outside work, and, up to the time midterm grades are issued, a course overload. Until the last four weeks of classes in the semester, the instructor must certify the student's standing in the course as satisfactory or as failing. In the former case a WP will be entered on the permanent record and in the latter, a WF. During the last four weeks of classes in any semester, or the equivalent in the summer terms, W will be assigned if, in the judgment of the student's dean, compelling and extraordinary circumstances make it necessary for the student to drop the course; otherwise, the course must be continued

to the end of the semester. A course discontinued without approval will result in a grade of F.

When students note an error in their course schedules, they should consult with their academic dean.

Course Changes for the Summer Terms. Course changes are accomplished through ACES, the telephone registration system. Duke students who are blocked from continuing into a summer term must see their academic dean.

Courses may be added before or during the first three days of the term (see also the section on late registration and payment). After the third day of the term, no course may be added. Prior to the first day of the term, students may drop a course or courses for which they have registered without penalty. During the first three days of the term, students will be charged \$150 per course (\$75 per half-course) for dropping a course or courses if this results in any reduction in course load for the term. With the permission of the academic dean a course may be dropped until the end of the fourteenth day of a regular summer term (eleventh day at the Marine Laboratory); the instructor then assigns a WP or WF grade. Course work discontinued without the approval of the dean will ordinarily result in a grade of F. (See also the section on Withdrawal Charges and Refunds.)

Course Load and Eligibility for Courses

Students are reminded that it is their responsibility to be certain that their course load conforms with academic requirements. The normal and expected course load in the fall or spring term is four semester courses. Students should take note that two additional semester credits are needed in order to meet the thirty-four (34) semester-course requirement for graduation. To take fewer than four or more than five semester courses, students must have the approval of their academic deans. No student, however, may take more than six courses in any semester. With the approval of their academic dean, seniors in Trinity College and the School of Engineering who need fewer than eight semester courses for graduation requirements may take an underload.

Maximum course program for one term of the summer session is two courses, one of which may be a laboratory course. Students in the School of Engineering may enroll in two laboratory courses. In addition, a student may enroll in a physical education activity or dance activity course for one-half course credit.

Self-pacing during a given calendar year (two regular semesters plus two Duke summer terms) is possible with the approval of the student's academic dean and faculty advisor (and in consultation with the Office of Undergraduate Financial Aid, if the student is receiving monetary support from the University). Prior to the beginning of a semester, a student may apply to take fewer than four courses for one or more semesters in a given calendar year after the freshman year, providing the student can meet the continuation requirements described in the chapter "Degree Programs." Advanced placement credits and summer work taken elsewhere are excluded when minimum annual continuation requirements are considered under this plan.

Eligibility for Courses. The rules established by the Graduate School provide that juniors and well-qualified sophomores may enroll in a 200-level (senior-graduate) course if they have obtained written consent of the instructor, as well as that of the Director of Graduate Studies in the department concerned. Undergraduate students may not enroll in 300- or 400-level courses.

Seniors who, at the beginning of the final term, lack no more than three semester courses toward the fulfillment of the requirements for the Bachelor of Arts or Bachelor of Science degree may enroll in graduate courses, for a maximum course load of five semester courses. Admission to the Graduate School is necessary.

Students may not register for two courses meeting at the same time. In Trinity College no course may be repeated for credit or a grade if a C- or higher has been earned

previously, except where noted in the course description. Physical education activity courses may be repeated, but without graduation credit. A course previously passed, however, may be audited.

Students who receive a *D-*, *D*, or *D+* in any course in Trinity College are allowed to repeat the course at Duke. The grade earned in the repeated course as well as the grade earned originally appear on the transcript, the former identified as a repeat; both grades count in the grade point average, but the credit for only one counts toward the required number of courses for continuation and the thirty-four (34) courses required for graduation. Forms requesting to repeat a course are available in the offices of the academic deans.

Course Audit

Students who audit a course submit no daily work and take no examinations. They do not receive credit for the course. With the written consent of the instructor, a full-time degree student is allowed to audit one or more courses in addition to the normal program. Physical education activity, studio art, applied music, and dance technique/performance courses may not be audited. In the fall or spring term, a part-time degree student may audit courses by payment for each course audited. In a summer term, a student carrying two courses for credit may be given permission to audit, without additional fees, nonlaboratory courses with the above exceptions. A student in a summer term carrying less than a full program for credit may secure permission to audit (above exceptions apply) but is required to pay half the University fee for the course. After the drop/add period in any term, no student classified as an auditor in a particular course may take the course for credit, and no student taking a course for credit may be reclassified as an auditor. A student may not repeat for credit any course previously audited.

Courses may be audited by faculty members, staff, alumni, employees and their spouses, as well as spouses of currently enrolled students, and members of the Institute for Learning in Retirement; courses audited on the Microelectronics Center of North Carolina (MCNC) Network may be audited without concurrent enrollment in another course. Formal application is not necessary; written permission from the instructor must be obtained and a course card must be signed by the Director of the Office of Continuing Education. Consult the chapter "Financial Information" for the appropriate fee schedule. Auditors must register on the Friday before classes begin.

Independent Study

Independent study enables a student to pursue individual research and reading in a field of special interest under the supervision of a member of the faculty. A student—with the approval of an advisor, the instructor, and the Director of Undergraduate Studies in the instructor's department—may enroll in independent study for any term at Duke. In Trinity College, instructors of independent study courses are expected to meet with the students enrolled at least once every two weeks during the fall or spring and at least once each week during a summer term.

House Courses

House courses, offered in the fall and spring terms, are intended to encourage students to take initiative in creating academic experiences that are not offered by the departments. A house course must be hosted by a residential unit, sponsored by a faculty member in the arts and sciences, reviewed by the department of that faculty member, and approved by the Committee on Courses of Instruction of the Arts and Sciences Council. House courses carry a half-course credit. In the School of Engineering, house courses cannot be used to meet degree requirements. In Trinity College not more than two semester-course credits earned in house courses can be counted toward the course

requirement for graduation. House courses do not count toward other requirements. Grades are submitted only on the pass/fail basis. The academic deans can provide further details.

Submission of Term Paper

Students who wish (under unusual circumstances) to submit a single paper for credit in more than one course must receive prior written permission from each course instructor. The student must indicate the multiple submission on the title page of the paper.

Declaration of Major or Division in Trinity College of Arts and Sciences

Before declaring a major or interdepartmental concentration in Trinity College, students work with their premajor advisors and with other members of the faculty and staff to develop a "long-range academic plan," which outlines academic objectives and plans for meeting goals. The plan should describe the proposed major program, related classroom and outside experiences, and the general pattern of elective courses, as well as the means by which the student will meet established college requirements for graduation. Students may declare a major in the spring of the first undergraduate year. Those who elect to postpone their declaration of major will not file long-range academic plans during their first year but will be expected to discuss their progress in developing their plans with their advisors during each registration period. All students must secure formal approval of their long-range plans and must declare their major before the last day of classes in their fourth undergraduate semester. Forms for filing the official long-range plan and for registering the initial declaration of major are available in the Premajor Advising Center.

After declaring a major, students are assigned an advisor in the department of the major and an academic dean in the division of concentration. Students who, having already declared a major, wish to change their area of concentration complete a form in the Office of the Registrar and subsequently develop a revised long-range academic plan in consultation with appropriate faculty members in the new major department and, if necessary, with their academic dean. The second major should be declared in the Office of the Registrar before registering for the final term.

A student may declare an interdepartmental concentration after conferring with the Directors of Undergraduate Studies of the departments involved, and they or other advisors assist the student in preparing a program of course work. The program, which must be planned early in the undergraduate career, must consist of at least three courses beyond the introductory level in each of the departments. One of the departments should be identified as primarily responsible for the student's advising. A copy of the plan for the program, with a descriptive title which will appear on the student's permanent record, should be presented, along with the written approval of the Directors of Undergraduate Studies, to the appropriate academic dean. A student who declares an interdepartmental concentration must satisfy all other requirements for Program I.

A student may have a second major recorded on the permanent record; if the student's second major is not offered within the degree to be granted for completion of the first major, a notation of the second major will appear on the transcript. Majors offered within each degree are listed below:

Bachelor of Arts. African and Afro-American studies, art design, art history, biology, biological anthropology and anatomy, Canadian studies, chemistry, classical languages, classical studies, comparative area studies, computer science, cultural anthropology, drama, economics, English, environmental science and policy, French, geology, Germanic languages and literature, history, Italian studies, literature, mathematics, medi-

eval and Renaissance studies, music, philosophy, physics, political science, psychology, public policy studies, religion, Russian, sociology, and Spanish.

Bachelor of Science. Biological anthropology and anatomy, biology, chemistry, computer science, geology, mathematics, physics, and psychology.

Changes in Status

Withdrawal and Readmission. Students who wish to withdraw from the college must give official notification to their academic dean. Notification must be received prior to the beginning of classes in any term or tuition will be due on a pro rata basis. (See the section on refunds in the chapter "Financial Information.") For students withdrawing on their own initiative after the beginning of classes and prior to the last four weeks of regular classes in the fall or spring term, or before the last two weeks of regular classes in a summer term, a *W* is assigned in lieu of a regular grade for each course. After these dates an *F* grade is recorded unless withdrawal is caused by an emergency beyond the control of the student, in which case a *W* is assigned by the student's academic dean.

Students may be involuntarily withdrawn for academic reasons, financial reasons, and violation of academic regulations. The expectations pertaining to each are found in the chapters "Degree Programs," "Financial Information," and this chapter, "Academic Procedures and Information."

Applications for readmission are made to the appropriate school or college. Each application is reviewed by officers of the school or college to which the student applies, and a decision is made on the basis of the applicant's previous record at Duke, evidence of increasing maturity and discipline, and the degree of success attendant upon activities during the time away from Duke. Students who are readmitted usually cannot be housed on campus.

Applications for readmission must be completed by November 1 for enrollment in the spring, by April 1 for enrollment in the summer, and by July 1 for enrollment in the fall.

Leave of Absence. An upperclassman in good standing may apply in writing to the appropriate academic dean to take a leave of absence for one or two semesters; the deadline for application for a leave is the end of the registration period for the semester immediately preceding the leave. Students returning from approved medical, financial, personal, or study abroad leaves and desiring housing on campus will be placed in the general housing lottery, provided they have submitted the appropriate information to the Office of Residential Life by their published deadline noted above and provided that they lived on campus before taking their approved leave. Unless an exception for an emergency is authorized by the students' academic deans, students applying after the course registration cited above will lose their priorities in University housing for the period following the leave.

Registration materials will be mailed to a student on leave, but final registration is, of course, contingent upon the student's fulfilling the terms of the leave. A student failing to register while on leave will be withdrawn from the University and will have to apply for readmission.

A student who undertakes independent study under Duke supervision and for Duke credit is not on leave of absence even if studying elsewhere. The student registers at Duke as a nonresident student and pays the appropriate fees or tuition at Duke. This also applies to Duke programs conducted away from the Durham campus.

Transfer between Duke University Schools. Students in good standing may be considered for transfer from one Duke undergraduate school or college to another, upon written application and request for a letter of recommendation from their academic dean. The review of requests to transfer involves consideration of a student's general academic standing, citizenship records, and relative standing in the group of students applying for transfer. The school or college to which transfer is sought will give academic

counseling to a student as soon as intention to apply for transfer is known, although no commitment will be implied.

A student may apply to transfer at any time prior to receiving a baccalaureate degree. A student transferring to Trinity College of Arts and Sciences from the School of Engineering, prior to receiving a baccalaureate degree, may not use more than six professional school credits toward the Bachelor of Arts or Bachelor of Science degree. If admitted after having earned a baccalaureate degree, a student must complete in Trinity College a total of seventeen additional courses. Transfer credit, AP credit, or courses previously used to satisfy requirements for the degree in engineering cannot be counted.

Full-Time and Part-Time Degree Status. Ordinarily candidates for degrees are expected to enroll for a normal course load each semester. Students who need to change from full-time to part-time status must request permission from their academic dean. Except for extraordinary circumstances, such permission is given only to students for the final semester of their senior year. So that the number of part-time students can be taken into account in enrollment and budget decisions, seniors must plan ahead and register their intention to be part-time one year in advance of the semester of part-time status. Part-time students may register for not more than two courses (or two courses and a half-credit physical education activity). Part-time students may not live in University housing.

Resident and Nonresident status. See the chapter "Campus Life and Activities."

Nondegree to Degree Status. A nondegree student must apply to the Office of Undergraduate Admissions for admission to degree candidacy.

Class Attendance, Excused Absences, and Tests

Responsibility for class attendance rests with the individual student, and since regular and punctual class attendance is expected, the student must accept the consequences of failure to attend. Instructors may refer to the student's academic dean a student who is, in their opinion, absent excessively. As a rule, absences from required classes and tests are excused only for illnesses certified by a medical official of the University or for authorized representation of the University in out-of-town events. Officials in charge of groups representing the University are required to submit the names of students to be excused to the appropriate deans' offices forty-eight hours before absences are to begin.

Class times are officially scheduled at registration unless designated "to be arranged" (TBA). No class time may be changed without prior permission of the University Schedule Committee. Within-class tests (except for the final) are to be given at the regular class meeting times. Exceptions are made for block tests that have been approved by the University Schedule Committee. Hours set up for block examinations are 7:30 to 8:45 A.M. on Tuesdays and Thursdays.

Incomplete Course Work

If because of illness, emergency, or reasonable cause a student cannot complete work for a course, the student may request in writing to his or her academic dean the assignment of an *I* (incomplete) for the course. If the request is approved by the instructor in the course and by the student's academic dean, then the student must satisfactorily complete the work prior to the last class day of the fifth week of the subsequent semester or a grade of *F* will be recorded for the course. An *I* taken in the fall semester must be resolved in the succeeding spring term; an *I* taken in the spring or summer must be completed in the following fall term. A student not enrolled in the University during that subsequent semester will have until the end of the fifth week of the next semester of matriculation to clear the *I*. An *I*, once recorded, will remain permanently on the student's record, even after the final grade is subsequently assigned for the course. If a

student whose work is incomplete is also absent from the final examination, an X is assigned for the course. Students may not complete work in a course after graduation. For a discussion of the possible impact of an I grade on continuation, see the sections on satisfactory performance each term in the chapter "Degree Programs."

Final Examinations and Excused Absences

The times and places of final examinations for the fall and spring terms are officially scheduled by the University Schedule Committee, generally according to the day and hour of the regular course meeting; changes may not be made in the schedule without the approval of the committee. If a final examination is to be given in a course, it will be given at the officially scheduled time. Take-home examinations are due at the regularly scheduled hour of an examination, based on the time period of the class. In fall or spring courses where final examinations are not scheduled, examinations may not be given in the last week of classes. In the summer session, final examinations are held on the last two days of each term as specified in the summer session brochure calendar. Final examinations for short courses are held on the last day of the course.

No later than the end of the first week of classes of the fall and spring term, the instructor is required to announce plans for the final examination exercise. Unless departmental policy stipulates otherwise, the form of the final exercise is determined by the instructor. However, a final written examination may not exceed three hours in length and a final take-home examination may not require more than three hours in the actual writing.

If a student is absent from a final examination, an X is given instead of a final grade. *An acceptable explanation for the absence must be presented to the appropriate academic dean within forty-eight hours after the scheduled time of the examination, or the X is converted to an F.* If the absence is excused by an academic dean, the student arranges with the dean and the instructor for a make-up examination to be given at the earliest possible time. An excused X not cleared by the end of the fifth week of the following semester is converted to an F. A student not enrolled in the University during that following semester has until the end of the fifth week of the next semester of enrollment to clear the X unless an earlier deadline has been established by the instructor and the academic dean.

Grading and Grade Requirements

Final grades on academic work are sent to students after the examinations at the end of each term. Midterm advisory grade reports for freshmen are issued in the fall and spring.

Passing Grades. Passing grades are A, exceptional; B, superior; C, satisfactory; P, passing (see pass/fail option below); and D, low pass. These grades may be modified by a plus or minus. A Z may be assigned for the satisfactory completion of the first term of a two-course sequence, and the final grade for both courses is assigned at the end of the second course of the sequence.

Although the D grade represents low pass, in Trinity College not more than two courses passed with D grades may be counted among those required for year-to-year continuation or among the thirty-four courses required for graduation. Courses for which a D grade is earned, however, satisfy other requirements. For information on repeating a course with a D grade, see the section on course load and eligibility for courses in the chapter.

Failing Grades. A grade of F or U (see pass/fail option below) indicates that the student has failed the course. The grade is recorded on the student's record. If the student registers for the course again, a second entry of the course and the new grade earned are made on the record, but the first entry is not removed.

Pass/Fail Option. With the consent of the instructor and faculty advisor, a student who has declared a major may register for grading on a pass/fail basis in one elective, nonmajor course each term. No degree requirements, except the requirement for thirty-four course credits and the continuation requirements, may be met by a course passed under the pass/fail option, unless the course is offered only on that basis. Preceptorials, discussion sections, seminars, and tutorials may not be taken on the pass/fail basis, unless the course is offered only on that basis.

After the drop/add period in any term, no changes from pass/fail to regular status, or from regular to pass/fail status, are permitted in any course. A *P* may not be converted subsequently to a regular letter grade, and the course may not be retaken under the regular grading system.

Grades When Absent from Final Examination. See the section on final examination and excused absences in this chapter.

Grades for Incomplete Work. See the section on incomplete work in this chapter.

WP, WF, and W Grades, and WE Designation. *WP* and *WF* grades may be issued if a student withdraws from a course after the drop/add period. (See the sections on course changes in this chapter.) *W* grades are issued if a student withdraws from the University before the last four weeks of regular classes in the fall or spring semester, or before the last two weeks of classes in a regular summer term. (See the section on withdrawal and readmission in this chapter.)

WE indicates correction of an error in registration. It is not a grade.

Academic Recognition and Honors

In determining a student's eligibility for annual recognition and graduation honors, the colleges consider only grades earned in Duke courses, including courses taken in the University's own study abroad programs and under the interinstitutional agreement.

Annual Recognition. In acknowledgment of high academic achievement, recognition is given each summer to freshmen, sophomores, juniors, and seniors if the following requirements are met:

1. A normal academic load has been carried in the fall and spring terms.
2. Grades other than *P* have been earned in six semester courses.
3. No incomplete or failing grade has been received during the fall and spring terms.

The *Dean's List* recognizes students who earn a 3.3 average on all work in both the fall and spring terms. The *Dean's List with Distinction* includes students who earn a 3.6 average on all work in both the fall and spring terms of an academic year.

Graduation Recognition. Academic excellence at graduation has been recognized at Duke at the departmental level by graduation with distinction in a disciplinary or interdisciplinary program and at the college level by Latin honors. These traditional forms of recognition continue. Beginning with students who entered Duke as freshmen in the summer or fall of 1988, a third form of recognition is available which combines features of both graduation with distinction and Latin honors—the honors project.

Graduation with Distinction. Academic departments and interdisciplinary programs of the colleges have programs leading to graduation with distinction. While these programs may vary in specific details, all have common basic features and all have been approved by the Honors Committee of the Arts and Sciences Council. To be eligible to begin a program leading to graduation with distinction, a student must show promise of achieving by the time of graduation at least a *B* average in the major field. In addition, departments may have special requirements regarding standards of performance. In the

School of Engineering, for example, some departments require at least a *B* average in all subjects and may have other requirements.

Departments or interdepartmental honors committees may invite a student at the end of the sophomore or junior year to enter the Graduation with Distinction Program. The student typically participates in a seminar in the junior or senior year and/or a directed course of reading, laboratory research, or other independent study. The student must eventually present the results of individual research and study in a piece of writing judged by a departmental committee to be distinguished. The student's achievement, including the paper, is assessed by a faculty committee, and if the student has at least a *B* average in the major field, the committee may recommend that the student be graduated with distinction in the major field. A student engaged in an interdisciplinary program, including Program II, must attain an overall *B* average for courses taken in the departmental area of concentration or special study; achievement is assessed by an interdepartmental honors committee established by the Directors of Undergraduate Studies in the departments concerned. A student may also be graduated with distinction in a program of studies that does not offer a major. In such a program the student must present a *B+* grade point average in the program field and a *B* average in all subjects. The papers of students in special programs will be evaluated by a committee drawn from the faculty within those programs. Interested students should consult appropriate Directors of Undergraduate Studies or Program Directors.

Latin Honors by Overall Academic Record. Overall academic excellence over the entire college career traditionally has been recognized by the designations *cum laude*, *magna cum laude*, and *summa cum laude*. At Duke students who earn the following averages for approved course work are graduated with honors: 3.4, *cum laude*; 3.7, *magna cum laude*; 3.9, *summa cum laude*.

Latin Honors by Honors Project. Latin honors may also be awarded by Trinity College to students who successfully complete an honors project in an individual department. Honors projects must be approved by departmental faculty at successive stages during a student's junior and senior years. A candidate for Trinity College honors by honors project must have an overall grade point average of 3.3 at the beginning and end of the project to qualify for departmental nomination. Departmental procedures governing honors projects and the nomination of students for Latin honors by honors project must be approved in advance by the Honors Committee of the Arts and Sciences Council.

Other Honors. Elections to the national freshman honorary society, Phi Eta Sigma, are made at the end of the fall and spring semesters. Students who earn a 3.5 average in four or more semester courses in their first semester of enrollment, or those whose cumulative average at the end of their second semester is 3.5 or above in a program of eight or more semester courses, are invited to membership.

Elections of undergraduate students in Trinity College and the School of Engineering to membership in the national honor society, Phi Beta Kappa, are held in the spring and fall. A review of the academic record of all prospective candidates is conducted in the junior and senior years as well as in the term following graduation. (Doctoral students, on the other hand, are nominated by their department.) Eligibility for election is determined not by the University, but by the local chapter of the society. No less than four-fifths of earned credits must have been taken on the regular grading system (A-F). The total number of persons elected annually is limited by bylaw to 10 percent of the graduating class. Eligibility requires a course of study with the breadth that characterizes a liberal education. The Program I curriculum meets those expectations; Program II and Engineering students must demonstrate comparable breadth in order to be eligible. Inquiries concerning distribution requirements for students in the School of Engineering should be directed to Professor Rhett George, Department of Electrical Engineering. All other inquiries may be directed to the Secretary of Phi Beta Kappa, Box 4795, Duke Station, Durham, North Carolina 27706.

Membership to the national academic honors organization, the Golden Key National Honor Society, is by invitation to the top 15 percent of University juniors and seniors in all fields of study. Chapter activities are service and interaction oriented, and members are encouraged to be active participants. Scholarships are awarded annually and career assistance is provided.

Elections to the national engineering honor society, Tau Beta Pi, are held in the fall and spring. Eligibility is determined on the basis of distinguished scholarship and exemplary character. Engineering students whose academic standing is in the upper eighth of the junior class or the upper fifth of the senior class have earned consideration by their local chapter. Inquiries may be directed to the Advisory Board, Tau Beta Pi, School of Engineering, Duke University, Durham, North Carolina 27706.

International Fellowships. Students interested in various prestigious fellowships for graduate study (for example, the Fulbright-Hays, Luce, Marshall, Rhodes, and Winston Churchill) should consult the academic dean in charge of fellowships, 04 Allen Building. Specific information about deadlines and procedures is available through that office.

Notification of Intention to Graduate

The Diploma Card for students in Trinity College of Arts and Sciences and the School of Engineering is official notification that they expect to have completed all requirements for the degree and to receive the diploma on a particular graduation date. It is the responsibility of students to file the card on or before established deadlines. For students in Trinity College, the cards, to be filed during the fall registration period, are available in the College Recorder's office; in the School of Engineering, the Dean's office.

Commencement

Graduation exercises are held once a year in May when degrees are conferred upon and diplomas are issued to those who have completed degree requirements by the end of the spring term. Those who complete the requirements by the end of the summer term or by the end of the fall term receive diplomas dated September 1 or December 30, respectively. There is a delay of one month to two months in the mailing of September and December diplomas because diplomas cannot be issued until they are approved by the Academic Council and the Board of Trustees.

Prizes and Awards

The achievements of undergraduate students are recognized in various fields of activity. The following prizes suggest the range of recognition.

The Edward H. Benenson Awards in the Arts. These awards of \$300 to \$3,000 are granted annually through the generosity of Duke alumnus and trustee Edward H. Benenson. Funds are awarded for fees, equipment, supplies, travel, production, and other educational expenses for projects in art, music, drama, dance, creative writing, and film/video proposed by undergraduates and graduating seniors of Trinity College and the School of Engineering. Application forms and instructions are available in February from the Institute of the Arts, 109 Bivins Building.

The Louis Sudler Prize in the Arts. An award is presented annually by the Institute of the Arts to a graduating senior who, in the opinion of a special institute committee, has demonstrated the most outstanding achievement in artistic performance or creation. The prize of \$1,000 was established in 1983 through the generosity of Louis C. Sudler, Chicago, Illinois.

The Janet B. Chiang Memorial Scholarship Fund. This fund was created by the family and friends of Janet B. Chiang. An award is made annually to a student who has demonstrated strong leadership qualities and a strong interest in his or her Asian cultural heritage.

The Sirena WuDunn Memorial Scholarship Fund. This fund was created by the family and friends of Sirena WuDunn. An award is made annually to a student who best embodies Sirena's ideals and interests and who has demonstrated academic excellence and an interest in Asian culture.

The Edward C. Horn Memorial Prize for Excellence in Biology. Given each year to the graduating biology major who has shown, in the opinion of the zoology faculty, the highest level of academic achievement and promise, this prize is offered in memory of Professor Edward C. Horn. It is a tribute to his warm regard for students and faculty and his appreciation of scholarly excellence. The prize consists of books appropriate to the student's field of interest.

CRC Outstanding Freshman Chemistry Award. A copy of the Chemical Rubber Company's *Handbook of Chemistry and Physics* is awarded annually to a freshman student in chemistry. The basis for selection by a faculty committee is academic excellence.

American Chemical Society Undergraduate Award in Analytical Chemistry. This prize is given annually by the Analytical Division of the American Chemical Society to an undergraduate student in analytical chemistry. The basis for selection is academic excellence and laboratory proficiency. The prize is a subscription to the journal *Analytical Chemistry* published by the American Chemical Society.

North Carolina Institute of Chemists Award. This prize is awarded annually to a graduating senior who has demonstrated a record of leadership and scholastic achievement and who has shown potential for advancement of the chemical and chemical engineering profession.

The Chemistry Department Award. This prize is awarded annually to an outstanding senior chemistry major in the Bachelor of Science degree program. The basis for selection is the student's independent research and interest in pursuing advanced work in chemistry. The prize is a one-year subscription to an appropriate journal.

The Merck Index Award. This prize is awarded annually to one or more graduating chemistry majors intending to pursue a career in medicine. Selection, by a faculty committee, is based on scholastic excellence. The prize consists of a copy of the *Merck Index* presented by Merck and Co., Inc.

The David Taggart Clark Prize in Classical Studies. This prize derives from income earned on the generous bequest (1956) of Professor David Taggart Clark, classicist and economist. It is awarded to the senior major in Greek, Latin, or Classical Studies who is judged to have written the best honors essay of the year.

The James B. Rast Memorial Award in Comparative Anatomy. The parents of James Brailsford Rast, a member of the Class of 1958 of Duke University, endowed this award in his memory. The award, consisting of the *Atlas of Descriptive Human Anatomy* by Sobotta and bearing the James B. Rast Memorial bookplate, is given annually to the student who demonstrates the greatest achievement in the study of comparative anatomy.

The Beth Gotham Semans Drama Scholarships. These awards are made annually to currently enrolled undergraduate students who have been and continue to be active in drama, with preference given to black and other minority students. Applicants need not be drama majors but must demonstrate significant involvement in dramatic activities. Awards range from \$1,000 to \$2,500; decisions are made by a special committee of the Institute of the Arts.

Emma A. Sheaffer Drama Scholarships. Awards ranging from \$150 to \$4,000 are given to students active in the Drama Program. Interested current and incoming students should make application to the director of the program.

The Steven and Toby Korman Drama Scholarships. Awards ranging from \$150 to \$4,000 are given to students active in the Drama Program. Interested current and incoming students should make application to the director of the program.

Kohler Drama Scholarships. Awards ranging from \$150 to \$4,000 are given to students active in the Drama Program. Interested current and incoming students should make application to the director of the program.

John M. Clum Distinguished Drama Graduate Award. Named for the distinguished founder of Duke Drama, this award recognizes an outstanding graduating senior who has made extraordinary contribution to the life of the program, and who has exhibited the outstanding personal and professional qualities that mark Professor Clum.

The Reynolds Price Award for Script-writing. This award is presented annually by Duke Drama to a Duke undergraduate for the best original script for stage, screen, or television.

The Winfred Quinton Holton Prize in Primary Education. This prize was established in 1922 by gifts of Holland Holton, Class of 1907, and Lela Young Holton, Class of 1907, in memory of their son, Winfred Quinton Holton, with the income to be used to provide a prize for investigative work in primary education. This prize may be made annually. Competition is open to Duke seniors and graduate students

who are eligible to obtain certification to teach. A student who wishes to be considered for the prize must submit a paper to be judged by a faculty committee in the Program in Education.

The Robert J. Niess Award in French. Given each year to an outstanding French major in honor of Robert J. Niess, Professor of French at Duke University from 1972 to 1981.

The William T. Laprade Prize in History. This prize is offered in honor of William T. Laprade, who was a member of the Department of History at Trinity College and Duke University from 1909 to 1953, and Chairman of the department from 1938 to 1952. It is awarded to a senior who is being graduated with distinction and whose senior essay in history has been judged to be unusually meritorious.

The Bascom Headen Palmer Literary Prize. This prize was established in honor of Bascom Headen Palmer's achievement as recipient of the Hesperian Literary Society Medal in 1875, his senior year in Trinity College. It recognizes the best senior honors thesis in literary study each year.

Julia Dale Prize in Mathematics. This is an annual prize of at least \$100. The winner is selected by the Department of Mathematics on the basis of excellence in mathematics. In some years first and second prizes are given.

Karl Menger Award. This is an annual cash award. The winner is selected by the Department of Mathematics for outstanding performance in mathematical competitions.

The Henry Schuman Music Prize. A prize of \$350 is awarded annually to an undergraduate of Duke University for an original composition or a distinguished paper in music history or analysis. The award is sponsored by the Department of Music through a continuing gift from Dr. and Mrs. James H. Semans, who named the prize after Henry Schuman, a lifelong friend of the Semans and Trent families, a talented amateur violinist, and one who helped to build valued collections in the Duke library.

Giorgio Ciompi Scholarships. These music scholarships are given to students who can demonstrate talent and achievement on a string instrument. Although recipients are not required to major in music, they are required to study privately. These scholarships are at least \$500 and are renewable annually for up to four years as long as the student exhibits good performance and makes significant progress.

The Smith Memorial Scholarship. This scholarship of up to \$2,000, in memory of Marvin Boren and Elvira Lowe Smith, is awarded to an organist who is an undergraduate music major or a graduate student in performance practice. It is renewable as long as the recipient continues to study the organ and maintains satisfactory progress.

Keyboard Classics Magazine Scholarship. This music scholarship of up to \$1,000 is awarded on the basis of merit to an entering pianist. It is renewable annually as long as the recipient is registered for applied piano study and is making satisfactory progress.

Sheet Music Magazine Scholarships. Two music scholarships of \$750 each are offered annually to entering first-year instrumentalists on a competitive basis. Enrollment in applied music (in the principal instrument) and participation in a departmental ensemble are required. The awards are renewable for up to four years as long as these requirements are met and progress is satisfactory.

The Julia Wilkinson Mueller Prize for Excellence in Music. An award of \$300 will be presented to a graduating senior for achievement in musical performance.

Robert S. Rankin Political Science Awards

Award in American Government and Constitutional Law. An award to the outstanding student in the field of American government and constitutional law. A prize of at least \$150 is donated by a former student of Professor Rankin's, Judge Jerry B. Stone, A.B. '44, J.D. '48.

Award in American National, State, and Local Governments. An award to the outstanding student in the field of American national and/or state and/or local governments. A prize of at least \$100 is also donated by Judge Stone.

American Government Award for Leadership and Academic Achievement. One or more awards have been donated by Robert H. Connery, Professor Emeritus of Public Law and Government at Columbia University, and from 1949-65 a colleague of Professor Rankin's when both were members of the Duke faculty, and by a group of Professor Rankin's former students. These awards are given to students, chosen by the Department of Political Science, who have demonstrated excellence in the study of American government and whose past achievements and future promise manifests not only high intellectual attainments, but also an exemplary leadership role in service to Duke University or to the community as broadly defined.

Alona E. Evans Prize in International Law. An annual award to an undergraduate and/or graduate student in arts and sciences whose paper(s) on international law reflect(s) excellence in scholarship.

Substantial money prizes are derived from income earned on the generous bequest of Professor Alona E. Evans, A.B. '40, Ph.D. (political science) '45.

Elizabeth G. Verville Award. An annual award to the undergraduate who submits the best paper in the subject matter of political science. Funds for the award of \$100 are derived from a gift by Elizabeth G. Verville, a political science major, A.B. '61.

Procter and Gamble Award. An award to the graduating senior major in political science who has achieved the highest university cumulative grade point average. Prize money is derived from a generous donation from the Procter and Gamble Fund's Departmental Grant Program.

The Marguerite (Mimi) Voorhees Kraemer Award. This annual award was created by the family and friends of Mimi Voorhees, a Public Policy Studies major, class of 1979. It recognizes a PPS student who has demonstrated strong leadership qualities and a commitment to public service. This award is given as a scholarship to help defray the costs of participating in the summer internship program.

The Joel Fleishman Distinguished Scholar Award. Named for the distinguished Founding Director of the Sanford Institute of Public Policy, this award recognizes the graduating major with the highest academic achievement in public policy.

The Terry Sanford Departmental Award. This award is presented annually by the Sanford Institute of Public Policy to the graduating major recognizing his/her achievement in leadership.

The Karl E. Zener Award for Outstanding Performance of a Major in Psychology. The Karl E. Zener Award is given to a psychology major who has shown outstanding performance and scholarship. The award, based on the student's total grade record and a paper submitted to the award committee, consists of a monetary prize and inclusion by name on a memorial plaque in Zener Auditorium.

Chester P. Middleworth Awards. These awards were established to encourage and recognize excellence in research and writing by Duke Students in their use of primary source materials held by the Special Collections Library. Two cash awards are made annually to undergraduates through the Special Collections Library, which is housed within Perkins Library.

The Richard L. Predmore Award in Spanish. Given each year to an outstanding Spanish major in honor of Richard L. Predmore, Professor of Spanish at Duke University from 1950-1978 and Dean of the Graduate School from 1962-1969.

The William Senhauser Prize. Given by the mother of William Senhauser in memory of her son, a member of the Class of 1942, who gave his life in the Pacific theater of war on August 4, 1944. This award is made annually to the student in Trinity College of Arts and Sciences or the School of Engineering who has made the greatest contribution to the University through participation and leadership in intramural sports. The winner of this prize is chosen by a committee appointed by the President of the University.

Kevin Deford Gorter Memorial Endowment Fund. This fund was created by the family of Kevin Deford Gorter to assist, promote, and expand the Sport Clubs program at Duke University. An award is made annually to the student who has made the greatest contribution to the program and best exemplifies the purposes of Sport Clubs at Duke University.

The Roger Alan Opel Memorial Scholarship. A grant is awarded annually to a Duke student who will spend a year of undergraduate study at a British university. The student is selected on the basis of intellectual curiosity, academic ability, and financial need. The award was established by the parents of Roger Alan Opel, a senior at Duke University who was killed in November, 1971.

The William M. Blackburn Scholarship. This fund was established in 1962 to honor William Blackburn, distinguished teacher of writing at Duke. The scholarship, awarded by the Department of English, recognizes outstanding achievement in the field of creative writing.

The Anne Flexner Memorial Award for Creative Writing. This award was established by the family and friends of Anne Flexner, who graduated from Duke in 1945. Open to all Duke undergraduates, the competition for prose fiction (5,000-word limit) and poetry (200-line limit) is sponsored in the spring semester by the Department of English. Entries are judged by the department's Committee on Creative Writing; awards range from \$200 to \$500.

The Rudolph William Rosati Fund. Established in 1978 by Mr. W. M. Upchurch, Jr., this fund honors the memory of his friend, the late Mr. Rosati, a talented writer. Awards are given to encourage, advance, and reward creative writing among undergraduate students. A committee named by the Provost oversees the program and distribution of the fund.

The Margaret Rose Knight Sanford Scholarship. This fund was established in recognition of the untiring efforts of Margaret Rose Knight Sanford on behalf of Duke University. The scholarship provides

financial assistance to a female student who demonstrates particular promise in creative writing. Awards are made by the Department of English.

The Francis Pemberton Scholarship. This award was created by the Trustees of the Mary Duke Biddle Foundation in memory and in honor of Francis Pemberton's service to The Biddle Foundation. The scholarship is awarded by the Department of English to a junior or senior pursuing the study of creative writing.

The E. Blake Byrne Scholarship. This fund was created in 1986 by E. Blake Byrne (Trinity College, Class of 1957). The award is made by the Department of English to rising juniors with demonstrated talent in creative writing who will receive partial scholarships over the next two years of undergraduate study.

The Raymond D. Lublin, M.D. Premedical Award. This award is given to an outstanding graduating senior who will be attending medical school and who has excelled in both science and non-science areas of the curriculum was established in the name of an honored physician and surgeon by his wife, Mrs. Raymond D. Lublin.

The Walter J. Seeley Scholastic Award. This award is presented annually by the Engineers' Student Government to that member of the graduating class of the school who has achieved the highest scholastic average in all subjects, and who has shown diligence in pursuit of an engineering education. The award was initiated to honor the spirit of academic excellence and professional diligence demonstrated by the late Dean Emeritus Walter J. Seeley. It is hoped that this award will serve as a symbol of the man and the ideals for which he stood. The name of the recipient is inscribed on a plaque displayed in the Engineering Building.

The American Society of Civil Engineers Prize. The prize is awarded annually by the North Carolina Chapter of the American Society of Civil Engineers to two outstanding civil engineering seniors, upon recommendation of the faculty of the civil engineering department. The basis for selection is the student's scholastic record, contribution to the student chapter, and participation in other college activities and organizations. The prize consists of a certificate of award and the payment of one year's dues in the American Society of Civil Engineers.

The George Sherrerd III Memorial Award in Electrical Engineering. This award is presented annually to the senior in electrical engineering who, in the opinion of the electrical engineering faculty, has attained the highest level of scholastic achievement in all subjects and has rendered significant service to the School of Engineering and the University at large. The award was established in 1958 by the parents of George Sherrerd III, a graduate of the Class of 1955, to recognize outstanding undergraduate scholarship. Recipients receive a monetary award, and their names are inscribed on a plaque displayed in the Engineering Building.

The Charles Ernest Seager Memorial Award. This award recognizes outstanding achievement in the annual Student Prize Paper Contest of the Duke branch of the Institute of Electrical and Electronics Engineers or significant contributions to electrical engineering. The award, established in 1958 by the widow and friends of Charles Ernest Seager, a graduate of the Class of 1955, consists of inscribing the name of the contest winner on a plaque displayed in the Engineering Building.

The Milmoze Prize. This prize is awarded annually to students from North or South Carolina graduating in the Department of Electrical Engineering, who, in the opinion of the faculty of that department, and, as shown by their grades, have made the most progress in electrical engineering during the last year in school. The prize consists of a certificate of award and one year's payment of dues in the Institute of Electrical and Electronics Engineers for the membership year in which the honoree is awarded the baccalaureate degree.

The Raymond C. Gaugler Award in Materials Science and Engineering. This award is presented annually to the senior who has made the most progress at Duke in developing competence in materials science or materials engineering. The basis for selection is the student's scholastic record, research, or design projects completed at Duke, and interest in a materials-related career. The award has been established by Patricia S. Pearsall in memory of her grandfather, Raymond C. Gaugler, who was President of the American Cyanamid Company prior to his death in 1952.

The American Society of Mechanical Engineers Award. This award is presented annually to a senior in mechanical engineering for outstanding efforts and accomplishments in behalf of the American Society of Mechanical Engineers Student Section at Duke. The award consists of a certificate of recognition.

The School of Engineering Student Service Award. This award, established in 1978, is given to those graduating seniors who, by their contributions of time, effort, and spirit, have significantly benefited the community of the School of Engineering. The names of the recipients are inscribed on a plaque displayed in the Engineering Building.

The T.C. Heyward Scholarship Award. This award is presented annually to an outstanding senior in mechanical engineering at Duke University. The recipient is chosen by a committee of the mechanical engineering faculty and selection is based on academic excellence, engineering ability, and leadership. The recipient receives a monetary award and his or her name is inscribed on a plaque displayed in the Engineering Building.

The William Brewster Snow Award in Environmental Engineering. This award is presented to an outstanding senior in civil engineering who, through superior academic achievement and extracurricular activities, has demonstrated interest and commitment to environmental engineering as a career. Selection of the recipient is made by the civil engineering faculty. The recipient is presented with an inscribed plaque and his or her name is also inscribed on a plaque permanently displayed in the Engineering Building.

The Otto Meier, Jr. Tau Beta Pi Award. This award was established in recognition of Dr. Meier's leadership in establishing the North Carolina Gamma Chapter in 1948 and his continuous service as chapter advisor until 1975. This award is given annually to the graduating Tau Beta Pi member who symbolizes best the distinguished scholarship and exemplary character required for membership. The name of the recipient is inscribed on a plaque displayed in the Engineering Building.

The da Vinci Award. This award is presented by a faculty committee of the Department of Biomedical Engineering to the biomedical engineering senior with the most outstanding academic record. This award commemorates the contributions of Leonardo da Vinci in laying the foundations for the study of biomechanics.

The von Helmholtz Award. This award is presented by a faculty committee of the Department of Biomedical Engineering to the biomedical engineering senior who has made the most outstanding contribution to the department. This award commemorates the work of von Helmholtz in laying the foundations of biomedical engineering.

Aubrey E. Palmer Award. This award, established in 1980, is presented annually by the faculty of the Department of Civil and Environmental Engineering to a civil engineering senior in recognition of outstanding academic achievement. The award consists of a certificate of recognition and the name of the recipient inscribed on a plaque displayed in the Engineering Building.

The Mechanical Engineering and Materials Science Faculty Award. This award is presented annually in recognition of academic excellence to the graduating mechanical engineering senior who has attained the highest level of scholastic achievement in all subjects. The name of the recipient is inscribed on a plaque displayed in the Engineering Building.

Education Records

Duke University adheres to a policy permitting students access to their education records and certain confidential financial information. Students may request review of any information which is contained in their education records and may, using appropriate procedures, challenge the content of these records. An explanation of the complete policy on education records may be obtained from the Registrar's office.

No information, except directory information (see below), contained in any student records is released to persons outside the University or to unauthorized persons on the campus, without the written consent of the student. It is the responsibility of the student to provide the Office of the Registrar and other University offices, as appropriate, with the necessary specific authorization and consent.

Directory information includes name, addresses, telephone listing, photograph, major field of study, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance, degrees and awards received, and most recent previous educational institution attended. This information may be released to appear in public documents and may otherwise be disclosed without student consent unless a written request not to release this information is filed in the Office of the Registrar by the end of the first week of classes each term.

Special Study Centers, Programs, and Opportunities



Campus Centers and Institutes

CENTER FOR INTERNATIONAL STUDIES

The University's Center for International Studies coordinates and supports a wide array of research and teaching activities on international issues in Arts and Sciences and the professional schools. Faculty associated with the center come from diverse disciplines and reflect a wide range of intellectual interests. Their primary bond is a concern with peoples, events, movements, and institutions outside the United States; relations among nations; and activities and institutions in the United States that affect the rest of the world. These faculty share the belief that many, if not most, matters of importance occurring within the United States have significant effects abroad and that important activities that take place abroad frequently affect this country. They agree that the awareness of relationships among peoples, events, cultures, movements, institutions, and processes are essential for an appreciation of the world in which we live and deserve primary emphasis in teaching and research in the University.

The functions of the center are to provide focus, structure, and support to the research efforts of associated scholars and to serve as a catalyst for the coordination of varied research undertakings. It also assists in dissemination of these undertakings and fosters international activities in educational, research, and governmental institutions in the southeastern United States.

The Center for International Studies is involved in monitoring and initiating change in the international curricula of the undergraduate, graduate, and professional schools of the University. It has a special interest in undergraduate education and, through a variety of programs and activities, makes a contribution to the undergraduate academic experience. It seeks to attract students to the wide range of international and comparative courses available and administers the major of the Program in Comparative Area Studies, where students can concentrate on Africa, East Asia, the Caribbean, Latin America, the Middle East, Russia and Eastern Europe, South Asia, Canada, or Western Europe. (See the chapter "Courses of Instruction.") All students are encouraged to pursue study abroad opportunities as well as language study in non-Western and Western languages. The center sponsors symposia on international topics organized by groups of Comparative Area Studies majors and also funds summer stipends for majors to conduct research abroad for senior honors papers, as well as awards to rising sophomores for summer travel and research overseas.

The center also works toward establishing a closer relationship between foreign students and those interested in international studies (see the section on International House in the chapter "Campus Life and Activities").

Area studies function in centers, institutes, or programs in the following areas:

African Studies. This program brings together faculty with a common interest in problems of the African continent. It encourages course work and lectures in African studies. Associated faculty work closely with students concentrating on Africa in the major in comparative area studies.

Asian/Pacific Studies. This program, administered by the Asian/Pacific Studies Institute, supports and encourages Asian and Pacific studies with special emphasis on Japan and China. Courses offered cover a range of disciplines including Japanese, Chinese, Korean, anthropology, economics, art, history, political science, music, and religion. The institute provides support for visiting lecturers and conferences and makes available a limited number of fellowships annually. Study abroad opportunities are available in China and Japan. An East Asia concentration is possible for majors in comparative area studies.

Canadian Studies. The Canadian Studies Center administers the Canadian Studies Program, which offers courses introducing students to various aspects of Canadian life and culture. Courses and lectures in a wide range of disciplines in the humanities and the social sciences are designed to increase students' knowledge and understanding of Canada. Special emphasis is placed on Canadian problems and comparisons of Canadian and American perspectives. Concentrations in Canadian studies are described in the chapter "Courses of Instruction." Study abroad opportunities are available.

South Asian Studies. The South Asian Program combines scholars from Arts and Sciences and the professional schools whose research deals with the societies and cultures of the Indian subcontinent. The program offers courses in Hindi-Urdu, an introductory course on the civilizations of the Indian subcontinent, and topical courses presenting a wide-ranging view of the past and present of the Indian subcontinent. Majors in comparative area studies may elect a South Asian concentration. The program also helps sponsor cultural events put on by the Duke University South Asian Students Association.

Comparative Islamic Studies. This program focuses on the entire Muslim world from North Africa to Southeast Asia. Course offerings include an interdisciplinary undergraduate survey of Islamic civilization and courses in Islamic history and religion. The program offers several levels of Arabic language and literature as well as Persian, Hindi/Urdu, and Swahili. It also sponsors lectures, conferences, and film series on aspects of Islamic culture and a summer program in Morocco.

Latin American Studies. The Council on Latin American Studies administers a comprehensive program in Latin American studies. A wide range of courses in the humanities, the social sciences, Portuguese, and Spanish is offered. Visiting professors and lecturers from Latin America, a speakers series, conferences, and summer programs abroad are supported by the program. Faculty associated with the program work closely with students majoring in comparative area studies who concentrate in Latin America.

In addition, the Council and the Institute of Latin American Studies at Chapel Hill sponsor the Duke-University of North Carolina Program in Latin American Studies that includes yearly faculty exchanges of two faculty members from each institution, pre-dissertation awards for travel in Latin America, joint undergraduate and graduate student seminars, graduate student colloquia, and faculty-student research working groups.

Caribbean Studies. The Caribbean Studies Committee focuses its activities on the problems and issues common to the various societies in this culturally diverse region. The committee views the Caribbean region as an ideal laboratory for analysis of issues such as colonialism, race relations, and development problems. The program works closely with the Council on Latin American Studies to serve the needs of students with an interest in this area.

West European Studies. Faculty associated with this program promote comparative research, graduate training, and teaching activities concerned with historical and contemporary European issues. Attracting a large number of undergraduate comparative area studies majors, this popular program regularly sponsors campus-wide events, such as conferences on contemporary trends in European politics and society and recent developments in the European Community. The committee is currently spearheading an effort to establish a Center for European Studies which will be jointly sponsored with a similar committee at the University of North Carolina at Chapel Hill.

Slavic, Eurasian, and East European Studies. This committee coordinates interdisciplinary efforts primarily in the fields of Russian (including Soviet) and East European history, economics, political science, literature, linguistics and language training. Language instruction in Russian, Polish, and Ukrainian is available. The committee also sponsors visiting lectures, conferences, symposia, and films.

In addition, the center promotes interdisciplinary research and teaching around thematic issues. These thematic interdisciplinary committees in 1993-94 include

Citizenship and Civil Society. This interdisciplinary committee, which includes faculty from sociology, political science, history, and philosophy, focuses on the political and public construction of rights and duties in society. The examination of citizenship brings into focus the newly emerging concerns of rights, obligations, and personhood; and the study of civil society examines how the web of associations operates in the public sphere to protect, promote, and change political and economic democracy. The main areas of empirical interest are the emerging democracies of Europe and the changing welfare state in advanced industrialized countries. The group sponsors a monthly reading seminar and talks throughout the year.

Comparative Labor Studies. This committee brings together historians, sociologists, political scientists, and other faculty members at Duke with interests in labor and the working class. The committee in particular promotes scholarship and teaching dealing with the comparative study and history of labor in different nations.

Ethnicity and Nationalism. This committee is intended to stimulate research and teaching interest at Duke and in the Triangle area on comparative aspects of nationalism and inter-ethnic relations in various parts of the world, particularly, but not exclusively, in Eastern Europe and the former U.S.S.R. The committee's primary activity is a monthly interdisciplinary faculty seminar, open to a limited number of graduate students interested in dissertation research on the topic. The seminar includes presentations from faculty at Duke, UNC-Chapel Hill, North Carolina State University, and other area scholars, as well as outside guest speakers. The committee has several other projects: collection of relevant course syllabi, publication of a series of working papers, and a major conference.

Gender in International Perspective. This interdisciplinary, cross-cultural committee brings together scholars at Duke who are interested in, or have already incorporated into their scholarship, a gender component. It also invites international scholars to the campus. Recently, the committee has devoted considerable time and effort to establishing a study group focused on the intersections of war and gender. In August 1993 this subgroup will convene an international conference at the Rockefeller Center in Bellagio,

Italy. The aim of the conference is to develop a dialogue between feminists and military scholars.

Hemispheric Studies. This program brings together faculty whose research inter-relates U.S., Canadian, and Latin American studies. It is currently sponsoring a long-term interdisciplinary research project on the social, political, and cultural implications of North American economic integration. Administered by the Center for International Studies, this research project involves faculty from the Centro de Estudios Internacionales at El Colegio de México and the Norman Paterson School of International Affairs at Carleton University.

Post-Colonial Productions in Anglophone and Francophone Cultures. This group, composed of humanities faculty, focuses on the comparative cultural preoccupations of the former colonies and the collective memory of the peoples of the British and French empires. It considers cultural productions in the novel, poem, travelogue, diary, music, theatre, and film/television by taking more of a cultural studies approach to evolving forms than the traditional literary one. Committee members share their own ongoing research as well as invite to campus overseas researchers who are producing parallel work on such current topics of literary theory as creolization/hybridity, multiculturalism, Otherness (and its discontents), colonizer versus colonized, difference and sameness.

CENTER FOR RESEARCH ON WOMEN (Duke-UNC Chapel Hill)

The Duke-UNC Center for Research on Women was founded in 1982 as a collaborative endeavor between Duke University and the University of North Carolina (Chapel Hill) to promote women's studies scholarship and research; to support curriculum development in women's studies; and to disseminate women's studies research and information throughout the South. The center principally seeks to explore the dynamics of gender, race, and class, with a particular emphasis on the American South.

Its regular activities include a working paper series, a biannual newsletter, publications, and the sponsorship of conferences, colloquia, and community events. Students seeking information should inquire at 207 East Duke Building (Duke), (919) 684-6641 or at 03 Caldwell Hall 009A (University of North Carolina, Chapel Hill), (919) 966-5787.

CENTER FOR DOCUMENTARY STUDIES

This interdisciplinary center for research, teaching, and the dissemination of documentary studies is dedicated to encouraging and supporting the work of photographers, filmmakers, historians, journalists, novelists, and others who work by direct observation and participation in the lives of individuals and communities. The center is currently focusing on four areas of research: the American family, African American life and race relations, law and politics, and ecology and the environment. A variety of center sponsored projects offer a limited number of assistantships to graduate students in the arts and humanities. The center also offers courses under the auspices of several Duke departments including history, public policy studies, education, and English. For more information consult Iris Tillman Hill, Director, Center for Documentary Studies, 331 West Main street, 5th Floor, Snow Building, Durham, North Carolina 27701.

CONTINUING EDUCATION

Academic Study. Local adult residents are encouraged to pursue academic study at Duke (1) as potential degree candidates, for those who have not been full-time college students for at least four years and are now resuming or beginning a bachelor's degree; (2) as nondegree students, for those with baccalaureates who now seek a sequence of undergraduate credit courses; and (3) as students completing the last year of work towards a degree at another institution. These students are given academic counseling

by the Office of Continuing Education and University Summer Programs and are subject to most of the regulations set forth for degree candidates. Continuing education applications may be obtained from the Office of Undergraduate Admissions and must be returned to that office, accompanied by a \$35 application fee, by August 1 for the fall semester and by December 1 for the spring semester.

Career Development Services. Career Development Services assists persons making decisions about returning to work, re-entering school, career planning and assessment, life/work transitions, and individual goal setting. Individual appointments, group sessions, and workshops are held.

Short Courses and Conferences. Short courses (noncredit) in the liberal arts are offered regularly throughout the year for those interested in personal enrichment or career advancement. Conferences, institutes, and training programs are conducted during the academic year and in the summer. Some are residential and others are designed for local participants. Some award continuing education units.

The Institute for Learning in Retirement. The institute is for persons over fifty years of age who recognize in themselves a need to continue learning and sharing knowledge.

For brochures on each program and for fuller information, write or call the Office of Continuing Education and University Summer Programs, The Bishop's House, East Campus, (919) 684-6259.

INSTITUTE OF THE ARTS

The Institute of the Arts is a center for the interdisciplinary presentation, support, production, and study of the arts. The institute coordinates artist residencies on campus and in the community, presents series in contemporary performance, world music/dance, and an annual Contemporary Arts Festival. Working with a representative faculty council, the institute coordinates and supports new curricular initiatives in the arts and works to develop cooperative programs between Duke and the surrounding community. An undergraduate certificate program in the arts is offered as well as a one-semester, off-campus residency program, Duke in New York Arts. The institute is also the administrative home for the Duke Dance Program. It provides support for student and faculty projects in the arts and administers awards and prizes. For further information, inquiries should be made to Duke University Institute of the Arts, 109 Bivins Building, (919) 684-6654.

INSTITUTE OF STATISTICS AND DECISION SCIENCES

The Institute of Statistics and Decision Sciences was founded in 1985 to conduct and coordinate teaching and research in statistics and the application of quantitative methods to the study of decision making. The institute offers a wide range of course work and consultation in mathematical statistics, statistical modeling, applied statistics, statistical computing, decision analysis, and utility theory. Students interested in the activities of the institute should consult the institute office, 333 Old Chemistry Building, (919) 684-4210.

Programs Not Offering Majors

Through the programs described below, students have the opportunity to engage in the concentrated study of an area not offering a major. These programs, supplements to the basic course of study, usually reach beyond departmental boundaries and generally provide an interdisciplinary focus to the subject matter. If completed, many offer official recognition of participation, often in the form of a certificate. More information may be obtained from the directors of the programs.

ASIAN AND AFRICAN LANGUAGES AND LITERATURE

Established in 1988, the Program in Asian and African Languages and Literature (AALL) offers courses in the languages, literatures, cultures, and linguistics of more than two thirds of the world's population. These languages include Arabic, Chinese, Hebrew, Hindi, Japanese, Korean, Persian, and Swahili. To qualify for the certificate in AALL, students must take two years of introductory and intermediate language instruction, a core course, and four other courses taken from AALL listings. Full details concerning the program and its courses can be obtained by writing or calling the director, Professor Miriam Cooke, Asian and African Languages and Literature, 2101 Campus Drive, 919-684-4309.

DANCE

The Dance Program offers its students the opportunity to study modern dance, ballet, dance history, choreography, repertory, and non-Western dance forms in an environment that challenges the student's intellectual, expressive, and physical capabilities. A balanced integration between the creative/performance and the historical/theoretical aspects of dance is emphasized. Academic courses in dance provide a historical and theoretical foundation for the student's creative work. In turn, the student's participation in dance creation and performance, and the development of technical skill, deepen the student's scholarly appreciation of the medium. With this approach the aim of the program is to develop students who are sensitive physical communicators of the visual art of dance and who are articulate spokespeople for the art form.

The program offers courses in technique, performance, and theory. A certificate is available to students who meet the requirements for it, as described in the Courses of Instruction section of this bulletin. Students are urged to enroll in at least one summer session with the American Dance Festival. If appropriate to the student's specific course of study, one course credit earned at the American Dance Festival may be counted toward the certificate requirements. Through the Duke in New York Arts Program, a student has the opportunity in the fall semester of the junior or senior year to pursue the study of dance in New York City; appropriate courses taken at New York University may fulfill certificate requirements.

FILM AND VIDEO

The Program in Film and Video introduces students to the critical analysis of new communications technologies: film, photography, and television. Practical experience in 16mm film and videotape production is also available through course work and internships. Established in 1986, this program also sponsors speakers, film and video screenings, and exhibits under the rubric of Screen/Society. For further information, students should consult the program director, Professor Jane Gaines, 107A Art Museum, (919) 684-4130.

THE FOCUS PROGRAMS

The Focus Programs are designed to explore educational opportunities arising from selected groups of first year students in small classes, many of them seminars, and featuring a curriculum in which courses are designed to enrich each other. Each of the following programs includes a required half-course designed to emphasize the interdisciplinary nature of the program. It will meet once a week over dinner.

Twentieth-Century America (Fall). The Twentieth-Century America Program explores modern American society in a group of interrelated courses from the perspectives of history, literature, sociology, religion, and political thought. The program offers five

courses in the fall, of which participants must take at least three, including the university writing course.

This special program provides the student with the opportunities that come from relatively small classes (often of seminar format), a program of interrelated and mutually reinforcing courses, and close relationships with professors and stimulating fellow students.

Courses that the program has offered include University Writing Course (special section), History 93S, Sociology 101S, Political Science 144S, and Religion 60S (see descriptions in this bulletin). Further information and application forms may be obtained from the Premajor Advising Center.

Science, Technology, and Modern Culture (Fall). The purpose of this program is to explore important developments in the sciences in the twentieth century, their historical significance, and their sociocultural impact. Faculty in botany, zoology, chemistry, mathematics, physics, engineering as well as history, philosophy, sociology, English, and literature will from time to time offer seminars in this program. Four or five seminars in addition to specially designed sections of the University Writing Course (UWC) will be available. These seminars will be interrelated in content and limited in enrollment to no more than twenty students in each seminar. In addition to UWC, students should select one non-science course and at least one science or mathematics course. Further information and application forms may be obtained from the Premajor Advising Center.

Evolution and Humankind (Spring). Students in this program will study the evolution of human beings and the diversity and similarity of human experience. Topics will range from studies of cognition and of such behaviors as aggression and altruism to issues of health, human development, aging, and equality of race and gender. Faculty in biological anthropology and anatomy, cultural anthropology, sociology, zoology, philosophy, religion, and psychology will offer seminars in this program. Four seminars interrelated in content will be offered and limited in enrollment to no more than twenty students. Each student will select at least two seminars from the program, but may take all four of the seminars. Students may apply for this program during the previous summer or in the fall.

Contemporary Global Culture (Spring). This program will explore the social, economic, political, and moral aspects of African, Asian, and Latin American cultures in a global context. Faculty in English, literature, religion, cultural anthropology, comparative area studies, history, and political science will from time to time offer seminars in this program. The program will also involve appropriate foreign language departments. Four seminars interrelated in content will be offered and limited in enrollment to no more than twenty students in each seminar. Each student in the program will select at least two seminars but may take all four of the seminars. Students may apply for this program during the previous summer or in the fall.

HEALTH POLICY

Through its Center for Health Policy Research and Education, the University offers undergraduates a sequence of health policy courses whose successful completion will lead to a certificate. The certificate sequence in health policy culminates in an integrative group project. For further information, inquire at the Center for Health Policy Research and Education, Suite 125 Old Chemistry Building.

HUMAN DEVELOPMENT

This interdisciplinary program provides opportunities to compare and to explore the complementarity of disciplinary perspectives on the biological, biomedical, psychological, social, and cultural aspects of human development. The program, which is more

fully described under "Courses of Instruction," integrates courses, a research apprenticeship, and special events through an active advisory procedure. For more information and a program brochure, consult Professor Robert J. Thompson, Jr., (919) 684-5072.

INTERDISCIPLINARY GERMAN STUDIES

The Interdisciplinary German Studies Program unites offerings from art and art history, Germanic languages and literature, history, music, philosophy, political science, religion, Slavic languages and literatures, and sociology. It offers a perspective on the world in so far as it has been shaped by individuals and societies who use the German language. Students in the program may earn a certificate by taking a prescribed group of courses outlined in the chapter "Courses of Instruction."

Students may also pursue this program in Germany while participating in a Duke-approved study abroad program during a summer or during their junior year. Duke offers its own summer program at the Friedrich Alexander University in Erlangen/Nürnberg and a spring semester program at the Free University of Berlin. For further information consult the Director of the Program in Interdisciplinary German Studies, Department of Germanic Languages and Literature, 104 Languages Building, (919) 684-3836.

JUDAIC STUDIES

Duke University through the auspices of the Center for Judaic Studies offers a full range of courses in Judaic civilization. Participating departments and programs include religion, Germanic languages, Asian and African languages, comparative literature, history, political science, international studies, anthropology, and women's studies. Also, courses may be taken at nearby Chapel Hill where additional courses are offered under the rubric of the Joint Program in Judaic Studies. A full range of courses is available in classical and modern Hebrew as well as in Yiddish. Students desirous of further language training or specialization may elect to pursue their studies in Israel during their junior year at a Duke approved program.

The program in Judaic studies is largely focused on undergraduates who may earn a certificate in Judaic studies after taking any four nonlanguage courses, or who may pursue Judaic studies under Program II, the alternative program option. This option offers a student the flexibility to design, with the aid of a faculty advisor, a curriculum to accommodate unusual interests and talents. Some students may also choose to concentrate on Judaic studies within the context of a religion major; such students are also eligible to receive a certificate.

Duke regularly sponsors its own summer program in Israel and over 700 students have participated in it to date. For further information, inquire at the Center for Judaic Studies, Box 90964, Duke Station, Duke University, Durham, North Carolina 27708-0964.

MARKETS AND MANAGEMENT STUDIES

The Program in Markets and Management Studies is designed to meet the needs of undergraduates who wish to combine a liberal arts education with preparation for careers in business management, advertising, public relations, and retailing. Students choose from a wide range of courses in a number of departments in seeking to understand how business enterprises operate and how markets for goods, services, and labor are changing in an increasingly competitive global economy. Core courses, offered by the Department of Sociology, place a heavy emphasis on case studies of actual management and marketing problems and are intended to teach a broad range of analytical and practical skills.

A certificate is awarded on completion of the requirements for the program. Participants in the program are offered the chance to use film and video materials for extraclassroom discussion, have the use of a resource room, and can compete for research funds. The program also seeks to facilitate business internships for qualified

students. For further information consult Professors Kenneth Spenner or John Wilson in the Department of Sociology.

NEUROSCIENCES

The Neurosciences Program reflects the rapid developments in our understanding of brain mechanisms and behavior. Undergraduates are offered opportunities to learn about these developments in new and existing courses. The approach to the neurosciences is broad, covering the cellular and subcellular levels (molecular and genetic properties, cell and membrane physiology, neurochemistry), systemic levels (neuroanatomy, sensory and reflex function, brain disorders), and integrative levels (perception, memory, behavioral genetics, evolution of brain and behavior). The program emphasizes breadth in the arts, sciences and humanities, with an understanding of the neurosciences as an integral part of a liberal education. Students interested in the neurosciences should request information from the co-directors, professors W. G. Hall (psychology) and Stephen Nowicki (zoology).

PERSPECTIVES ON MARXISM AND SOCIETY

Perspectives on Marxism and Society is a program devoted to the study of Marxist theories of society. Courses in the program focus on Marxism, not primarily as a political or ideological system, but as a scholarly methodology incorporating a variety of analytical techniques across a wide range of disciplines. The unifying theme of the program is a critical appraisal of Marxist methods of analysis and their social implications, considered in the light of theoretical alternatives and changing historical circumstances. Courses included in the program cover a wide range of subjects, including sexual and racial inequality, alienation, development and underdevelopment in the world system, labor processes, protest movements, and ideologies.

Students in the program will be required to take a core course in varieties of Marxist analysis. Four additional approved courses, no more than three from one department, will complete the program of study. A certificate will be awarded to those who meet the requirements of the program. Students in the program will be expected to major in another discipline, with the program a supplement to their major. Full details concerning the program and its courses can be obtained by writing or calling the director, Professor Fredric R. Jameson, Graduate Program in Literature and Duke Center for Critical Theory, 104 Art Museum, (919) 684-4127.

PRIMATOLOGY

The Primatology Program provides an interdisciplinary investigation of primate development and evolution from the anatomical, ecological, and behavioral perspectives. Theoretical issues arising from sociobiology and new fossil discoveries will be tested as to their validity when applied to human evolution. The course of study leads from a generalized introduction through more specialized topics to the design and completion of a research project at the Duke University Primate Center or in a faculty laboratory under the guidance of a faculty member. The final step is an oral presentation of the research results in a senior seminar. For more information on the Primatology Program call the Department of Biological Anthropology and Anatomy at the Wheeler Building, (919) 490-6286.

SCIENCE, TECHNOLOGY, AND HUMAN VALUES

The Program in Science, Technology, and Human Values provides students an opportunity to explore the social and cultural dimensions of science, technology, and medicine. Through course work and a wide variety of extracurricular activities, students are introduced to the perspectives and insights of other disciplines in order to develop a richer and more informed understanding of their own field of specialization. The

program brings together students and faculty from the sciences and engineering with their counterparts in the humanities and social sciences, with a heavy emphasis on interdisciplinary study and discussion. Detailed information is given in the chapter "Courses of Instruction" in the Bulletin.

WOMEN'S STUDIES

The Women's Studies Program is a multidisciplinary forum for the study of women's roles and gender differences in various societies, past and present. Established in 1982, it offers courses, lectures, films, programs, and research support and brings together faculty and students from all fields who are concerned with both the theoretical questions stemming from the study of gender in the disciplines as well as the implications of such investigations for women and men in contemporary societies. The program seeks to encourage the use of new scholarship, which in the last two decades has challenged empirical and theoretical understandings of the sexes, from the perspectives of the humanities, the social sciences, and the biological sciences. From 1985 until 1990, the program housed the editorial offices of *Signs: Journal of Women in Culture and Society*, providing students with the opportunity to be involved in the development of the most recent scholarship on women and cultivating an environment on campus that recognized feminist scholarship as an important intellectual endeavor. The program offers both graduate and undergraduate certificates, as well as a variety of other opportunities for involvement. For more information on Women's Studies, inquire at the program office at 207 East Duke Building, (919) 684-5683.

RESERVE OFFICER TRAINING CORPS

Duke University and the military services cooperate in offering officer education programs to provide opportunities for students to earn a commission in the United States Air Force, Army, Navy, or Marine Corps. The programs are described below, and detailed information on scholarships, entrance requirements, and commissioning requirements is available from the offices of the Department of Air Force Aerospace Studies, the Department of Military Science (Army), and the Department of Naval Science. Courses offered in these departments are described in the chapter "Courses of Instruction" in this bulletin.

The Air Force Reserve Officer Training Corps (AFROTC). AFROTC selects, trains, and commissions college men and women as officers in the U.S. Air Force. AFROTC offers a four-year and a two-year curriculum leading to a commission as a second lieutenant. The four-year program consists of both the General Military Course (GMC), a course sequence taken during the freshman and sophomore years, and the Professional Officer Course (POC) taken during the junior and senior years. Entry into the POC is competitive and requires successful completion of a field-training encampment between the sophomore and junior years.

The GMC is open to freshmen and sophomores. Students who complete both the freshman and sophomore years of the program and successfully compete for entry into the POC will attend a four-week training encampment. All other successful POC applicants will attend a six-week encampment. Students interested in the two-year POC program should submit applications no later than early spring semester of their sophomore year. Between the junior and senior year, POC cadets are given the opportunity to volunteer for advanced training in a variety of different areas.

Cadets may compete for scholarships varying in length from two years to three and one-half years. These scholarships pay up to full tuition, books, and a monthly tax-free stipend of \$100. All members of the POC receive the nontaxable stipend. Upon graduation all cadets are assigned to active duty with the U.S. Air Force for a period of at least four years. Direct inquiries to the Department of Aerospace Studies, 304 North Building, (919) 684-3641.

The Army Reserve Officers' Training Corps (AROTC). Army ROTC provides students with an opportunity to earn a commission as a second lieutenant in the U.S. Army, U.S. Army Reserve, or Army National Guard while completing requirements for a baccalaureate degree. Two programs are available, a four-year and a two-year program.

The four-year program consists of the Basic Course (freshman and sophomore years) and the Advanced Course (junior and senior years). Direct entry into the Advanced Course is possible under specific circumstances (two-year program). Students wishing to join the two-year program must confer with the Department of Military Science not later than April 1 of their sophomore year. There is only one mandatory summer training requirement, Advanced Camp, which takes place over a six-week period between the junior and senior years. All uniforms and AROTC texts are provided.

Upon commissioning, the service obligation may be served on active duty, in the Army Reserve, or in the Army National Guard, as directed by the Secretary of the Army. At the beginning of the senior year, cadets submit a preference statement concerning the method by which they wish to fulfill their service obligation and the specialty in which they desire to serve. A request to delay the fulfillment of the service obligation in order to attend graduate or professional schooling is also authorized.

Cadets are encouraged to compete for Army ROTC scholarships which pay 80 percent tuition, most fees, a generous textbook and equipment allowance, and \$100 per month for each month in school (up to \$1,000 per year). Nonscholarship Advanced Course cadets also receive the \$100 monthly stipend. All of the above benefits are tax-free. Participants in Advanced Camp are paid one-half of the basic pay of a second lieutenant.

Detailed information is available from the Department of Military Science, 06 West Duke Building, East Campus, (919) 684-5895, or 1-800-222-9184.

The Naval Reserve Officer Training Corps (NROTC). The Department of Naval Science offers students the opportunity to become Naval and Marine Corps officers upon graduation. Selected students may receive up to four years of tuition, fees, uniforms, and textbooks at government expense under the auspices of the Scholarship Program. In addition, scholarship students receive subsistence pay and summer active duty pay of approximately \$1,300 a year. They participate in four weeks of summer training either aboard ship or at naval shore facilities to augment their academic studies. Four years of active duty service as a Regular Officer is required upon graduation.

Nonscholarship students may be enrolled in the College Program. They take the same courses and wear the same uniform, but attend the University at their own expense. Uniforms and naval science textbooks are provided by the government. During the last two academic years, they are enlisted in the Naval Reserve, receive \$100 per month subsistence pay, and participate in summer training. Three years active duty service as a Reserve Officer is required upon graduation.

College Program students may compete for scholarship status through academic performance, demonstrated aptitude for military service, and nomination by the Professor of Naval Science. Students in either program may qualify for a commission in the Marine Corps through the Marine Corps Option Program. Students seeking further information on the NROTC program may call the Department of Naval Science, Hanes House, (919) 684-3841.

Off Campus Opportunities

STUDY ABROAD (Office of Foreign Academic Programs)

A Duke student may earn credit for approved work completed during the academic year at a foreign university or for an approved program abroad sponsored by Duke or by another approved American college or university in the fall, spring, and summer. To

receive the maximum amount of study abroad transfer credit at Duke—generally four course credits for a full semester, eight for a full academic year, two for a summer—a student is expected to take a full, normal course load, as defined by the other institution involved. The responsible Duke departments, however, make the final decision on the final number of credits transferable. Students attending British universities for the full academic year can transfer a maximum of eight courses. However, for the short single fall trimester only three course credits can be transferred. Students attending British universities in the spring are generally required to attend the two remaining trimesters and can transfer a maximum of five credits. No additional study abroad transfer credit will be awarded for a course overload. A leave of absence from the University is granted for a semester or academic year of approved study abroad. Duke-administered programs do not involve transfer credit and do not require a leave of absence. Arrangements are made normally for students to register, while abroad, for the term in which they plan to return. Seniors planning to spend their last semester abroad are subject to the residence requirement and may face postponed graduation because transcripts from abroad are often delayed.

Semester and Academic Year Programs

A student who wishes to receive transfer credit for study abroad should take into account the following criteria established by the faculty and administered by the Committee on Study Abroad:

1. a scholastic average of at least a *B*- (a student lacking this average may petition the academic dean responsible for study abroad if there are unusual circumstances);
2. certification, when applicable, from the foreign language department concerned, that the student has an adequate knowledge of the language of the country in which study is pursued;
3. approval, obtained before leaving Duke, of the appropriate Directors of Undergraduate Studies for the courses to be taken abroad, as well as approval of the program and the courses by the dean responsible for study abroad and by the student's academic dean;
4. permission for leave of absence once program plans are complete.

Duke, at present, offers various programs in cooperation with other universities during the fall and spring terms. Students accepted may study in:

Austria. From time to time Duke sponsors a term program in Vienna for members of the Wind Symphony.

Britain. Duke has agreements with a number of top British universities, allowing our students to become members of outstanding teaching and research institutions in Britain for a semester or academic year. The universities currently available are the University of London (King's College, the London School of Economics and Political Science, Queen Mary and Westfield College, and University College), the University of Bristol, the University of Manchester, the University of Sussex, and Warwick University. There is a special program for engineers at University College London. Applications are available in 121 Allen Building.

Canada, Montreal. Duke students participating in the Duke/McGill University Exchange Program may spend one semester or academic year at McGill, located in the Quebec city of Montreal. Because the language of instruction at McGill is English, program applicants need not have studied French although some knowledge of it would be advantageous. The program is sponsored by the Canadian Studies Center and Trinity College; information and application forms are available in 121 Allen Building.

China. In cooperation with Nanjing University and Beijing Teachers College, Duke conducts a six-month study program in the People's Republic of China in the summer and fall terms. The program includes a fall term at Nanjing University preceded by an

intensive language session in Beijing. Participants must have at least one year of Chinese language. Information is available from the Asian-Pacific Studies Institute, 2111 Campus Drive, and in 121 Allen Building.

Egypt, Cairo. Through an agreement with the American University in Cairo, Duke students may spend a spring semester or academic year there taking regular classes with Egyptian students. They may enroll in general courses in humanities, social sciences, and sciences, as well as in Arabic language and specialized courses in Middle Eastern studies. Applications are available in 121 Allen Building.

England, Oxford. Through a special arrangement with several colleges at the University of Oxford, selected Duke students may spend their junior year at Oxford as regularly enrolled visiting students. The students are treated exactly like their British counterparts, and most of them live in college housing. Students may choose to concentrate their study in any one of the major fields in the humanities, social sciences, or selected natural sciences. Each student is assigned a tutor. Applicants must have a very strong academic record; previous course work in the subject to be pursued at Oxford is also required. More information may be obtained in 121 Allen Building.

France, Paris. Duke offers a full-year program in Paris in conjunction with the University of Paris-I, IV, and VII. The language of instruction will be French; one course will be offered by the Resident Director, and three courses will be taught by the Parisian faculty. Applicants must have completed four semesters of French plus two courses at the 100-level or above with a grade of at least B+. Priority will be given to juniors and full-year applicants, although some participants may be admitted for one semester only. More information may be obtained in 121 Allen Building or the Department of Romance Studies, 205 Languages Building.

Germany, Berlin. Duke students study at the Humboldt University of former East Berlin (fall) and at the Free University of former West Berlin (spring). Each semester they take specially arranged courses in German language and the social sciences for Duke credit, and they audit a course of their choosing at the German university. One year (fall or year program) or two years (spring program) of college-level German or its equivalent are required. More complete information may be obtained in 121 Allen Building.

India, Madras. Duke students may participate in a fall semester program administered by the consortium of the South Atlantic States Association for Asian and African Studies, of which Duke is a member. The program, which is offered in alternate years, offers courses in Indian history and culture, beginning Tamil, and independent research. More information may be obtained in 121 Allen Building.

Italy, Rome. As one of the participating members of the Intercollegiate Center for Classical Studies in Rome, Duke University may send classics majors and other students with strong classical interests for admission to a term's work at the center, usually in the junior year. Instruction is offered in Greek, Latin, ancient history, ancient art, and archaeology. Some scholarship help is available. Additional information may be obtained from the Department of Classical Studies, 236 Allen Building.

Japan, Tokyo. Qualified students may be recommended each year by the Asian-Pacific Studies Committee for the junior year exchange program with International Christian University in Tokyo. This small, select university is noted for the international character of its student body (85-90 percent Japanese, 10-15 percent non-Japanese, primarily from other Asian nations and the United States). Courses may be taken in English as well as Japanese. More information is available from the Asian-Pacific Studies Institute, 2111 Campus Drive, or 121 Allen Building.

Scotland, Glasgow. The Department of Public Policy Studies offers departmental majors the opportunity to study during the fall semester of their senior year at the University of Glasgow where, practically speaking, public policy analysis was invented. Students will live on campus and will take the program's special seminar in public policy in addition to three electives from the general university curriculum. Further informa-

tion may be obtained from the Director of Undergraduate Studies in the Department of Public Policy Studies, 217 Old Chemistry Building.

Spain. This program offers advanced students a variety of on-site experiences and an opportunity to hear and speak Spanish in an ideal environment. The program offers courses in Spanish history, culture, literature, politics, and arts, as well as several organized excursions. Students are housed with selected Spanish families. More information may be obtained in the Department of Romance Studies, 205 Languages Building, or in 121 Allen Building.

Further information concerning semester and academic year programs, as well as summer programs, may be obtained in 121 Allen Building. All Trinity College students are responsible for following the procedures and meeting the deadlines set forth in materials available in 121 Allen Building. In all cases, the dean of study abroad must be informed in advance about a student's plans.

Duke Summer Programs Abroad

The Office of Foreign Academic Programs, in cooperation with several University departments, provides many opportunities for students to study abroad while earning Duke University credit. Information about Duke Summer Programs Abroad and about the time they will next be offered can be obtained from the program directors or the Office of Foreign Academic Programs, 121 Allen Building.

Belgium/Netherlands. The Office of Foreign Academic Programs and the Department of Art and Art History offer a two-course, six-week program on the history of art and culture of Flanders and the Netherlands from the fifteenth through the seventeenth centuries. The program is based for the first two weeks in Amsterdam in the Netherlands and for the last four weeks at the University of Ghent in Belgium. The courses are taught in English by Professor Hans van Miegroet of the Duke Department of Art and Art History together with Dutch and Belgian faculty members. Participants visit numerous Dutch and Belgian museums. Students live in dormitories. For further information see Professor Hans van Miegroet, Department of Art and Art History, 112 East Duke Building.

British Isles, Cambridge. The Office of Foreign Academic Programs and various University departments offer a two-course, six-week program at the Cambridge University focusing on a comparison of British and American society and institutions such as the legal systems and health care systems. One course is taught by a Duke faculty member, the other by faculty members of British universities. Students live at Emmanuel College, Cambridge. For further information inquire at the Office of Foreign Academic Programs, 121 Allen Building.

British Isles, England, Durham/Scotland, Glasgow. The Office of Foreign Academic Programs and the Departments of Religion and English offer a two-course, six-week program at the universities of Durham and Glasgow on English fiction from the 1830s to the 1980s and its relation to religion. One course is taught by Professor Wesley Kort of Duke, the other by faculty members of the universities of Durham and Glasgow. Students live in dormitories of the universities. For further information see Professor Wesley Kort, Department of Religion, 328 Gray Building.

British Isles, England, London (Drama Program). The Office of Foreign Academic Programs, Duke Drama, and the Department of English offer a two-course, six-week program in London, focusing on the history and analysis of theater in Britain with study of dramatic texts and their production. One course is taught by Professor John Clum of Duke's Drama Program and Department of English, the other by a faculty member of the Department of Drama and Theatre Studies of the University of London. Students live in dormitories. For further information see Professor John Clum, Department of English, 304B Allen Building.

British Isles, England, London (Media Program). The Office of Foreign Academic Programs and the Department of Political Science offer a two-course six-week program

in London on the interaction of media and politics analyzing the nature and organizations of the British mass media, concentrating on television and the newspaper industry. The courses are taught jointly by Professor David Paletz of the Duke Political Science Department and by a British faculty member. Students live in dormitories. For further information contact Professor David Paletz, Department of Political Science, 501 Perkins Library.

British Isles, England, Oxford. The Duke/Oxford Summer Program, a six-week session at New College, Oxford, utilizes the Oxford tutorial system of education. The tutorial format is supplemented by the lectures given at the University of Oxford International Graduate Summer School by noted British scholars. Detailed information may be obtained in 121 Allen Building.

Canada. (Early July–mid-August). This two-course, six-week program provides a complete immersion in French. Students are placed in one of nine levels of language instruction during the program. Upon return they are tested and then placed in the appropriate level at Duke. Instruction and accommodations are by the University of Quebec, Trois Rivières campus. For further information consult Professor Clark Cahow, Canadian Studies Program, 2016 Campus Drive.

France. The Office of Foreign Academic Programs and the Department of Romance Studies offer a two-course, six-week program in Paris. It provides the opportunity to take Duke courses in the ambience of Paris. One course is in French language; the other is in French literature and culture. Both courses are taught in French. Students live in a hotel. For further information see Professor Clare Tufts, Department of Romance Studies, 205 Languages Building.

Germany, Erlangen/Nürnberg. The Office of Foreign Academic Programs and the Department of Germanic Languages offer two programs at the Friedrich-Alexander Universität at Erlangen, Germany. One program provides an opportunity to study classroom German at different levels while living with a German family and participating in study, day trips, and excursions (May and June). In the other program, advanced students may choose from a variety of FAU courses and remain for a full summer semester (through early August). Semester program students live in dormitories. For further information see Professor Helga Bessent, Department of Germanic Languages, 107 Languages Building.

Greece. The Office of Foreign Academic Programs and the Department of Classical Studies offer a one-course, four-week program in Greece featuring readings, walking lectures, and touring important sites and museums to study the development of the preclassical, classical, Roman, and Byzantine cultures in Greece. The course is taught by Professor John Younger of Duke. Students live in hotels. For further information see Professor Younger, Department of Classical Studies, 228 Allen Building.

India. The Office of Foreign Academic Programs and Asian and African Languages and Literature offer a two-course, six-week program in Bombay. One course deals with Indian history to the present and the other with the media in modern India and their influence on modern Indian society. Study trips to New Delhi and other important sites are part of the curriculum. Students live in a hotel. For further information see Professor Satti Khanna, Asian and African Languages and Literature, 2101 Campus Drive.

Israel. The Office of Foreign Academic Programs, the Department of Religion, and the Duke Center for Judaic Studies offer a summer program in Israel—in Jerusalem and Galilee—giving students an opportunity to participate in an archaeological dig and to explore historical and contemporary Israel, as well as Western religious traditions. Students live in dormitory-style accommodations. For further information see Professors Carol and Eric Meyers, Department of Religion, 227 Gray Building.

Italy, Florence. This two-course, six-week program will focus on Renaissance Florentine history and art. Courses will be taught in English under the direction of Professor Ronald Witt of Duke University. Students live in a hotel. For further information see Professor Ronald Witt, Department of History, 234 Carr Building.

Italy, Rome. The Office of Foreign Academic Programs, the Department of Classical Studies, and the Department of Art and Art History offer a one-course, four-week program in Rome and central Italy. Through visits to sites and museums, walking lectures, and readings, the course examines the history of the city of Rome from the earliest times through the Baroque and modern periods. Students live in dormitory-style accommodations. For further information inquire at the Office of Foreign Academic Programs, 121 Allen Building.

Japan. The Office of Foreign Academic Programs and Asian and African Languages and Literature offer a two-course, six-week program at Hosei University near Tokyo focusing on Japanese culture and society. One course is taught by Duke faculty, the other by faculty of Hosei University. Both courses are taught in English. Students live variously in a hotel, dormitories, and with families. For further information inquire at the Office of Foreign Academic Programs, 121 Allen Building.

Morocco. The Office of Foreign Academic Programs and Asian and African Languages and Literature, and various other departments offer a program at the University of Marrakesh. The course offerings vary from year to year. Courses are taught in English. Students live in hotels. For further information see Professor Vincent Cornell, Department of Religion, 118 Gray Building.

Russian Republic. The Office of Foreign Academic Programs and the Department of Slavic Languages and Literatures offer a two-course, six-week summer program in St. Petersburg. Russian language study at different levels is offered, as well as a course in Russian culture. Extensive excursions to Moscow and other cities are included in this program. Classes in St. Petersburg are taught at the University of St. Petersburg by faculty of the university. Students live in an apartment-hotel. For further information see Professor Edna Andrews, Department of Slavic Languages, 314 Languages Building.

Spain. The Office of Foreign Academic Programs and the Department of Romance Studies offer a two-course, six-week program at the advanced level in Madrid and Malaga with excursions to Toledo, Segovia, Granada, Sevilla, Cordoba, and Gibraltar. All courses are conducted in Spanish, and students live with Spanish families. For further information see Professor Miguel Garci-Gómez, Department of Romance Studies, 212 Languages Building.

Taiwan. The Office of Foreign Academic Programs, the Department of Sociology, and Asian and African Languages and Literature offer a two-course, six-week program at the Academia Sinica in Taipei focusing on modern Chinese society and development issues of East Asia. Students live in dormitories. The program begins with a seven-day excursion to Seoul. For further information inquire at the Office of Foreign Academic Programs, 121 Allen Building.

Zimbabwe/Botswana. The Office of Foreign Academic Programs and the Department of Political Science offer a two-course, six-week program based for three weeks at the University of Zimbabwe in Harare and for three weeks at the University of Botswana in Gabarone. The courses focus on politics and development of southern Africa and are taught in English by Duke faculty with guest lecturers from the Universities of Zimbabwe and Botswana. The program includes study trips to development projects, and excursions to Victoria Falls and Hwange (Wankie) Game Park. Students live in dormitories. For further information inquire at the Office of Foreign Academic Programs, 121 Allen Building.

DUKE UNIVERSITY MARINE LABORATORY (School of the Environment)

The Duke University Marine Laboratory (DUML) is located within the Outer Banks, adjacent to the historic seacoast town of Beaufort, North Carolina, with direct access to the Atlantic Ocean, Cape Lookout National Seashore Park, sand beaches and dunes, estuaries, wetlands, and maritime forests. Because of the dynamic collisions of offshore currents, the area provides an excellent opportunity for marine study. A component of

the School of the Environment, the Duke University Marine Laboratory is an interschool teaching and research facility dedicated to the study of coastal and oceanic processes and human disturbances of those processes. The Beaufort campus of Duke has available dormitory and dining facilities, classroom laboratories, research buildings, a specialized marine science library, as well as a variety of boats which are utilized in both teaching and research activities. A year-round seminar series which includes both guest lecturers and the resident academic and research staff additionally serves to enrich the student community.

At the undergraduate level, the Marine Laboratory serves students in the natural and environmental sciences as well as those in the social sciences, humanities, or engineering who have adequate preparation. Academic programs include a fall semester and spring semester for undergraduate juniors and seniors, summer courses designed for both undergraduate and graduate students, and a cooperative program for students from several colleges and universities. The academic programs integrate classroom lectures and laboratories with direct field and shipboard experiences. For additional information and application materials, write to the Admissions Office, Duke University, School of the Environment, Marine Laboratory, Beaufort, North Carolina 28516-9721.

AGREEMENTS WITH OTHER UNIVERSITIES

Neighboring Universities. Under a plan of cooperation, the interinstitutional agreement among Duke University and the University of North Carolina at Chapel Hill, North Carolina State University at Raleigh, and North Carolina Central University in Durham, a student regularly enrolled in Duke University and paying full fees may enroll for one approved course each semester at one of the institutions in the cooperative program. If the student takes two or more courses during a summer at Duke, one of the courses may be taken at one of the neighboring institutions under this plan. This agreement does not apply to contract programs such as the American Dance Festival.

Approval forms for courses to be taken at these neighboring institutions may be obtained from the offices of the academic deans at Duke. Ordinarily, only those courses not offered at Duke will be approved. Credit so earned is not defined as transfer credit since grades in courses taken under the interinstitutional agreement are entered on the official record and used in determining the quality point ratio. The student pays any special fees required of students at the host institution and provides transportation.

Howard University. Duke students participating in the Duke/Howard University Exchange Program may spend a semester studying at Howard University in Washington, DC, while Howard undergraduates enroll for the same period at Duke. More information about this program, administered by Trinity College, is available at 121 Allen Building.

Special Summer Programs

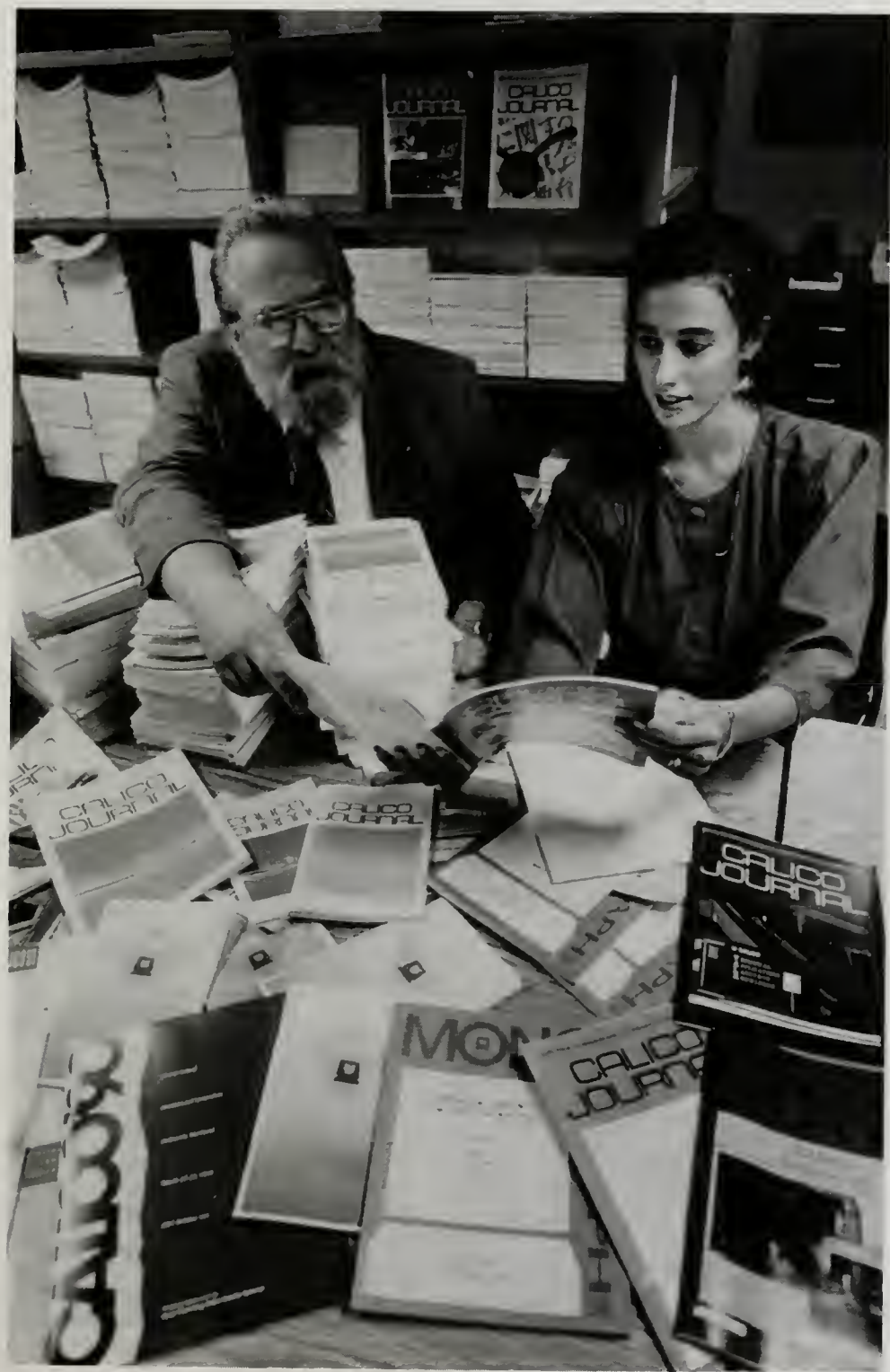
DUKE SUMMER FESTIVAL OF CREATIVE ARTS

The Duke Summer Festival of Creative Arts is administered jointly by the Summer Session Office and the Office of Cultural Affairs. The festival provides an exciting, artistically stimulating environment for the campus and community. The Ciompi Quartet, Duke's well-known Chamber Music Ensemble, will give several performances. Other special events such as jazz concerts, carillon recitals, dance and theater performances, and film series are planned.

The American Dance Festival. The six-week program offers a wide variety of classes, performances, and workshops. For a catalog, write to the American Dance Festival, Duke University, Box 6097 College Station, Durham, North Carolina 27708.

PRECOLLEGE PROGRAM

During the summer of 1993, Duke University will offer a Term II program for academically talented rising high school seniors from across the country. The PreCollege Program is designed to provide the academic challenge of college-level courses to qualified college-bound students and to help prepare them for the adjustments they will be making when they enter college as freshmen. Students will enroll in two regular summer session classes with Duke undergraduates. Introductory level courses in the humanities, social sciences, natural sciences, and languages will be offered for college credit. The students will live in supervised, air-conditioned University dormitories, eat their meals in the University dining halls, enjoy the opportunity of studying with distinguished members of the Duke faculty, and will have access to all University libraries and athletic facilities. In addition to the classroom experience, PreCollege students participate in a range of programs and activities designed to aid them in college selection, career exploration, and intellectual and social development. For further information contact the PreCollege Program, Duke University, Box 90747, Durham, North Carolina 27708-0747, (919) 684-3847.



Campus Life and Activities



Student Affairs

The mission of Student Affairs is to create opportunities and challenges for students to broaden their intellectual, spiritual, and emotional horizons—and, in so doing, to engage them with the widest range of persons both within the University and beyond in striving towards a community which reflects the highest aspirations of all its members.

The Division of Student Affairs complements the educational mission of the University by helping to relate many of the nonacademic components of the University to the academic experiences of the students. The residence halls, the athletic fields, the Chapel, and many student organizations play an important humanistic and holistic role in the students' university experience by developing leadership qualities, skills in interpersonal relationships, and appreciation for the care of the physical self. Thus, the university experience encompasses collectively the life of the mind, body, emotions, and, indeed, the spirit.

Residential Life

Duke has a long tradition as a residential university and has sought to provide convenient housing for the majority of the undergraduate students. While the University was established to provide a formal educational opportunity for students, Duke has always taken the position that education encompasses social and personal development as well as intellectual growth. In order to facilitate such a holistic approach, Duke seeks to provide a supportive environment substantially anchored in its residential program.

Although first-year students are required to live in the University residence halls, a number of upperclassmen choose to live off campus. Students enrolled beyond their fourth year of the undergraduate program cannot be granted space in University housing. Part-time students and former students who have been readmitted are not eligible for on-campus housing.

Residence Halls and Apartments. The University accommodates approximately 91 percent of its undergraduates in sixty-three residence hall living groups located on East, West, and North Campuses and in apartments located on Central Campus. Within one of the residence halls, there are language corridors for students interested in speaking French, Spanish, German, and Russian. Other residence halls house the Arts Theme House for students interested in, but not necessarily majoring in, the arts; the Women's Studies House; and students interested in community service.

University housing is considered to include residence hall space as well as Central Campus Apartments. Placement in any of these areas fulfills the University's obligation to house eligible students in University housing. Free on-campus bus service connecting East, West, North, and Central Campuses is provided by the University.

First-year students live together in residence halls clustered on several campuses; upperclass students reside not only in all-upperclass residence halls but also in Central Campus Apartments. Residential fraternities are housed in sections of upperclass residence halls; by tradition, sororities are not residential. Housing assignments for first-year students are made by lottery to residence halls while upperclass housing assignments are made by a combination of lottery and student choice. Within the residence halls, students live in single, double, or triple rooms. Living groups elect officers and organize social, intramural, educational and cultural programs, as well as community service projects.

All of the residence halls have resident advisors who live in the houses and are members of the staff of the Dean for Residential Life. These graduate and undergraduate students have broad responsibilities in the residential life of the University including counseling students with personal problems, advising the house governments, and serving as resource persons for students.

Residence Hall Programming. Educational and cultural programming is planned and presented throughout the year in the residence halls through the cooperative work of the Office of Residential Life, Trinity College of Arts and Sciences, the School of Engineering, and resident students. There are a number of faculty members in residence in both first-year student and upperclass houses. Faculty offices and seminar rooms are also located in several of the first-year student houses. The goals of these various residential programs are to enhance the quality of intellectual and social life for the residents on campus, to facilitate student-faculty interaction outside of the formal classroom, and to develop a greater sense of community within the individual residence halls as well as within the greater University.

Living Off Campus. The option of living off campus is available for students after the first semester of their first year, and those who choose it may retain their resident status and eligibility for University housing if they follow the proper procedures as published by the Office of Residential Life.

Dining Facilities

All students living in campus residence halls are required to participate in a dining plan. Several dining plans are available, all of which allow a student to make purchases in a wide variety of dining locations by accessing a prepaid account carried on the student identification card, or Duke Card (see 'Food and Other Expenses' in the chapter "Financial Information"). Duke Dining Services provides cafeterias, restaurants, fast food operations, delis, snack bars, ice cream/dessert shops and catering services.

Dining service operations are located on each campus. Facilities on East Campus include the East Food Court (a collection of food shops including a grill, oriental food station, salad bar/healthy food shop, pasta area, deli, pizza station, and a dessert/ice cream shop), the East Union Cafeteria, Upper East Side (snack bar), and the Magnolia Room (restaurant). On West Campus, students may use their dining plan in the Blue & White Room (cafeteria), the University Room (cafeteria), the Oak Room (restaurant), the Cambridge Inn (featuring the Weigh Station food bar, breakfast bar, deli, hot subs, pastry, and desserts), the Rathskeller Sports Bar (hamburgers, pasta, and sandwiches), the Boyd-Pishko Cafe (fast foods), and Licks (ice cream/frozen yogurt). North and Central Campus locations include Trent Drive Cafe and The Pub on Central Campus (specialty sandwiches, salads, and beverages).

University Catering accepts dining plan funds from individual students or student groups and will provide food and/or catering services for cookouts, study breaks,

banquets, parties, or any other campus event. Students may also use the funds in their dining plan to purchase food items in three campus convenience stores: Uncle Harry's General Store on Central Campus, The East Campus Store on East Campus, and the Lobby Shop on West Campus. Dining plan funds may also be used to order pizza and sub sandwiches delivered to campus from participating area businesses.

Religious Life

Two symbols indicate the importance of religion to this University since its founding: *Eruditio et Religio*, the motto on the seal of the University, and the location of the Duke Chapel at the center of the campus. People from all segments of the University and the community gather in Duke Chapel on Sunday morning to worship in a service which offers excellent liturgy, music, and preaching. The world's outstanding Christian preachers have preached from the Duke Chapel pulpit.

The Dean of the Chapel and the Director of Religious Life work with the campus ministers and staff from the Roman Catholic, Jewish, and Protestant communities, and with other groups to provide a ministry which is responsive to the plurality of religious interests on the campus.

Through the religious life of the University, students are encouraged to search for meaning, to ask the ultimate questions, to worship, to meditate in the beautiful chapel, to learn from outstanding theologians from a wide array of traditions, and to work to bring about a more just and humane society.

Services Available

The Student Health Program and Service. The Student Health Program, which provides medical service, advice, and education for all currently enrolled full-time students and part-time degree candidates, is administered by the Department of Community and Family Medicine, Duke University Medical Center.

The primary location for medical care is the Duke Family Medicine Center (Marshall Pickens Building) where students are seen, by appointment, for assessment and/or treatment. When a student's health needs warrant additional specialized treatment, the Duke Family Medicine Center serves as a portal of entry to other health resources within the Duke medical community. The Infirmary, another Student Health facility, provides inpatient treatment of illnesses too severe to manage in residence halls or apartments, but not requiring hospitalization. If necessary, Duke Public Safety provides on-campus transportation to the health care facilities. A Student Sports Clinic is also available for treatment of sports-related injuries.

The health education component of Student Health is headquartered at the Pickens Annex. There is also a satellite office, called the Healthy Devil Health Education Center, on West Campus. A full-time health education staff is available to assist students in making informed decisions that lead to healthy life-styles at Duke and beyond. Topics of concern and interest include alcohol and other drug usage, eating and nutrition, sexual activity, and stress management. Programs, meetings, and consultations are provided for groups and individuals.

A list of students in the Infirmary or hospital is routinely provided to the academic deans, who issue excuses to students when appropriate. However, information regarding the physical or mental health of Duke students is confidential, released only with the student's permission. This policy applies regardless of whether the information is requested by University officials, friends, family members, or health professionals not involved in the student's immediate care.

All currently enrolled full-time students and part-time degree candidates are assessed a Student Health Fee for each enrolled semester. This covers most of the services rendered within the Student Health Program. An optional Summer Health Fee for

students who are not enrolled in summer sessions is also available through the Bursar's Office.

In addition to the Student Health Service, the University makes available a plan of accident and sickness insurance to protect against the high cost of unexpected illnesses or injuries which are not covered by the Student Health Fee and would require hospitalization, surgery, or the services of specialists. This insurance covers students both on and off campus, at home, or while between home and school during interim vacation periods throughout the one-year term of the policy. All full-time students and part-time degree candidates are required to enroll in this insurance policy unless they show evidence that they are covered by other generally comparable insurance or are willing to assume the medical costs of any sickness or accident. This waiver statement, contained in the remittance form of the University invoice, requires that the name of the insurance company and policy number be indicated, as well as the signature of the student or parent. The Student Health Service strongly recommends that all students be covered by an accident and sickness insurance, whether it is the one provided by the University or not. International students are required to show proof of health insurance coverage (either the policy offered by Duke or comparable coverage) and may not assume responsibility for personal payment of health care cost.

Upon arrival on campus, all students receive a detailed brochure about the Student Health Program and the services covered by the Student Health Fee. Additional copies of the brochure are available at the Duke Family Medicine Center and at the Office of Student Life.

Counseling and Psychological Services. Counseling and Psychological Services (CAPS) provides a comprehensive range of counseling and developmental services to assist and promote the personal growth of Duke students. The professional staff is composed of psychologists, clinical social workers, and psychiatrists experienced in working with young adults. They provide evaluation and brief counseling/psychotherapy regarding a wide range of concerns, including such issues as self-esteem and identity, family relationships, academic performance, dating, intimacy, and sexual concerns. While students' visits with counselors are usually by appointment, emergencies are handled when they arise.

Each semester, CAPS offers a series of counseling groups and seminars focusing on enhancement of self-understanding and coping strategies. Support groups have been offered for second generation Americans; bulimic students; and gay, lesbian, and bisexual students. Seminars have addressed such topics as stress management, social skills development, bulimia, and dissertation problems.

As Duke's center for administration of national testing programs, CAPS also offers a wide variety of graduate/professional school admission tests. The staff is also available to the entire University community for consultation regarding student development and mental health issues affecting not only individual students but the campus community as a whole. They work with campus personnel, including administrators, faculty, student health staff, religious life staff, resident advisors, and student groups, in meeting needs identified through such liaisons. Staff members are also available to lead workshops and discussion groups on topics of interest to students.

CAPS maintains a policy of *strict confidentiality* concerning information about each student's contact with the CAPS staff. If a student desires that information be released to anyone, written authorization must be given by the student for such release. Evaluation and brief counseling/therapy as well as skills development seminars are covered by the student health fee. There are no additional costs for these services.

For additional information, see the *Bulletin of Duke University: Information and Regulations*, or call (919) 660-1000.

Sexual Assault Support Services. Located in the Women's Center, the Office of Sexual Assault Support Services offers advocacy, support, and twenty-four hour crisis

intervention services to victims of rape and sexual assault. The S.A.S.S. Coordinator trains groups such as the resident advisors and DARE (Duke Acquaintance Rape Education) and initiates ongoing educational programs to alert students to problems of sexual assault and interpersonal violence. She also coordinates Safe Haven, a program providing a safe space for women and victims of sexual assault on keg nights.

Career Development Center. The mission of the Career Development Center is to educate the students of Duke University in the arts of self-assessment, career exploration, career planning, and job hunting with the goal of helping them develop rewarding and fulfilling careers. The center primarily serves the students and alumni of Trinity College, the School of Engineering, and the Graduate School.

Career Counselors are on staff helping students early in their lives at Duke to begin the process of discovering career interest. Career Specialists then help students focus on specific career fields, including the arts, business, community service, education, engineering, mathematics, computer science and the physical sciences, government, health and life sciences, international careers, and mass media. Career Specialists also work closely with the faculty and the deans of Trinity College in directing students interest towards effective application to graduate and professional schools.

Programs and services of the center include the Career Apprenticeship Program offering semester-long internships in local area businesses, the Health Careers Internship Program offering experiences at the Medical Center and elsewhere in Durham, the Service Learning Project offering stipends for summer work in community service, the On-Campus Recruiting Program offering interviews for summer and permanent positions with a wide variety of national organizations, and the Credential Service which collects and sends letters of recommendation.

The Career Spectrum, a weekly career newsletter, is designed to keep students constantly aware of career-related opportunities on and off-campus. Announcements of job openings, career seminars, workshops, and information sessions are announced each week. The Career Library and Resource Room provide a wealth of printed and database materials on specific career fields and specific employers. CareerSource, a new online computer career database, provides information at computer clusters located throughout the University and is available until midnight on weekdays and 24 hours a day over the weekends. By using CareerSource, a student may review bulletins, information about the center, review summer and full-time job listings, and register to participate in center programs.

Offices for Program Planning

The University Union. The University Union brings together undergraduate and graduate students, faculty, administrators, employees, alumni, and others through a broad program of lectures, concerts, performing arts, exhibits, games, festivals, crafts, special events, dances, and film and video presentations and productions. It is governed by a board comprised of representatives of virtually all segments of the University community; the board also governs the operation of the Bryan University Center, where the Union is located.

The Bryan University Center is the hub of cultural, social, recreational, cocurricular, and service activities for students and other members of the campus community. In addition to the Union, the Bryan Center also houses the Community Service Center, Duke University Technical Services, a cafe, a snack bar, three theaters, a video auditorium, a post office, bank services, an art gallery, meeting rooms, offices for student organizations, an information center, a ballroom, a crafts center, a game room, lounges, a mall, and Cable 13 (the campus television station). Also located in the Bryan Center are the University stores which provide textbooks, supplies, trade books, magazines and newspapers, health and beauty aids, gifts, and wearing apparel.

Office of Student Life. The Office of Student Life develops and coordinates the new student orientation programs for first-year and transfer students and works closely with the First-year-student Advisory Council (FAC), which is composed of upperclass men and women who are selected for qualities of responsibility and leadership. The members of the First-year-student Advisory Council are each assigned small groups of first-year or transfer students. During Orientation Week, they welcome their new students and introduce them to the University; during the first semester, they continue their relationship with their students, helping them make the many adjustments to university life.

Other responsibilities of this office include coordinating the application of the general rules and regulations of the University, advising the participants in the judicial process, serving as a resource center for handicapped students, acting as a liaison with both the Student Health Service and the Department of Public Safety, coordinating the University's Emergency Response Protocol, and designing and implementing the Parents' Weekend program.

Office of Student Activities. The Office of Student Activities, located in the Bryan Center, is a resource for approximately three hundred University clubs and organizations.

The office staff is available for advice in planning events, for guidance in establishing new groups, and for information about activities of campus groups. The financial manager oversees aspects of the financial affairs of student groups, Greek organizations, and residential living units. This includes authorizing financial and payroll transactions; auditing certain financial accounts; offering bookkeeping, budgeting, and fund-raising workshops for treasurers; and providing financial advice on an ongoing basis.

The office offers a Complementary Education Program with instructional and programmatic aids to foster leadership, organizational, and financial skills among student leaders. An internship/career apprenticeship program provides students with opportunities to gain practical experience and develop job related skills in such areas as accounting, advertising, public relations, editing, administration, and data processing.

Office of Cultural Affairs. The Office of Cultural Affairs is responsible for the creation, coordination, and implementation of many of the cultural and popular programs which occur on campus. The office is directly responsible for the Duke Artists Series, the Chamber Arts Society Series, the Summer Festival of Creative Arts, and the scheduling of Page Auditorium. The office is also involved in jazz programming. With the exception of athletic events, all campus entertainment programs which require tickets are handled by Page Box Office, an extension of the Office of Cultural Affairs. The office serves as a clearinghouse for major events on campus so that date conflicts can be avoided. In addition to overseeing arts-related activities, this office assists in publishing and distributing the yearly edition of the *Duke University Calendar of Events*.

The Mary Lou Williams Center for Black Culture. The Mary Lou Williams Center for Black Culture was dedicated in memory of the "great lady of jazz" and former artist-in-residence whose name it bears. Since its beginning, the center has established its significance as the gathering place on campus where broadly-based issues of social/cultural relevance are addressed to an increasingly larger cross-section of the Duke Community. The center's audience includes greater numbers of students who are prepared to honor the wonder of African-American history and culture. Such is addressed each year in many programs and events celebrating black possibilities and black successes. Among past programs have been art exhibits by renowned African-American artists, musical events, film series, and a number of lecture-discussions of the relevant topics. In addition, the center has expanded its programs from the particularly black to include the Asian, Hispanic, Native American and Indian, all of which evoke new possibilities for multicultural appreciation.

The Women's Center. The Women's Center, an office serving both women and men, is the locus for advocacy, programming, and information/referral for students on gender issues. Working in cooperation with other University units such as the Women's Studies Program, Counseling and Psychological Services, and Student Health education, the mission of the center is to promote a safe, healthy, and mutually empowering climate for female and male students, both inside and outside the classroom.

The center offers research support and participates in University policy-making processes that concern gender and campus climate issues. The center provides support and direct advocacy for students who have gender-related concerns. There are an on-site library and resource and clippings files. In conjunction with the permanent staff, student staff develop and lead programming focused on three main issues: health, safety, and personal and professional development. Specific foci are women of color, lesbian and bisexual women, sorority women, safety issues, mentoring, and public relations.

The Women's Center serves as advisor to diverse student organizations, including sororities, Men Acting for Change, Duke Acquaintance Rape Education and politically-oriented groups. The Women's Center also includes the office of Duke Sexual Assault Support Services.

International House. International House is the center of cocurricular programs for over seven hundred students at Duke from seventy-three countries, as well as for U.S. American students who have lived abroad, are interested in other cultures, are considering study abroad (see the section on study abroad in the chapter "Special Programs"), or are planning to travel outside the United States. The International Association, sponsored by International House and composed of both U.S. American and foreign students, plans social and cultural programs which emphasize personal contact and informal exchange of ideas among students from diverse backgrounds. Included are weekly open houses with lectures, discussions, films, potluck dinners or parties; and periodic trips outside of Durham.

Programs of International House which assist students from abroad in participating in the life of the Duke and Durham communities include an intensive orientation program at the beginning of the academic year; the International Friends Program, in which interested international students may become acquainted with U.S. American families or individuals; Duke Partners, in which an international student is paired with a U.S. American partner for weekly meetings to work on language and life skills; Speakers' Bureau, which arranges for international students to speak at civic and social groups as well as schools in the Durham community; and English conversation classes which meet four hours a week on campus.

International House also has a visa specialist on the staff who works with students from abroad in fulfilling the various immigration and tax formalities involved in coming to Duke. Further information may be obtained from International House, 2022 Campus Drive, (919) 684-3585.

Office of Intercultural Affairs. The Office of Intercultural Affairs (OIA) holds responsibility for identifying and assisting with changes in the Duke University community which promote optimum growth and development for African-American, Asian-American, Latino-American, and Native American undergraduate and postbaccalaureate students. The office conducts such activities as public forums on student life, mentorship projects with University alumni, seminars for current issues for students of color, institutional research on students of color development, and serves as a resource for students of color issues for the University community.

The Community Service Center. The Community Service Center is a clearinghouse for the numerous volunteer and community service activities available to students, faculty, and employees. Through the center, members of the Duke community became involved with student service groups and community agencies. Tutoring and mentoring "at-risk" youth, helping to care for people with AIDS, serving meals at local homeless

shelters, and befriending senior citizens in town are a few of the many program options. The Community Service Center works to create opportunities for students to link their experiences in the community with their coursework. It also sponsors speakers, special events, training sessions, and other programs to raise awareness about contemporary social issues as well as strives to be a catalyst for creative partnerships between the University and the wider community.

Student Organizations

Associated Students of Duke University. The Associated Students of Duke University (ASDU) is responsible for articulating undergraduate student thought on issues relevant to the University and for working to improve the educational process and University environment. The working philosophy of ASDU is that students have the right to participate in the University's decision-making process on matters that affect the student body.

The Executive Committee is responsible for the implementation of all legislative action and for the coordination of the organization. It consists of the President, four Vice-Presidents (Executive, Student Affairs, Academic Affairs, and Facilities and Athletic Affairs), an Executive Secretary, an Administrative Secretary, an Attorney General, a Press Secretary, a Director of Student Services, a Business Manager, and a Director of Undergraduate Computing.

The ASDU legislature is composed of representatives from each undergraduate living group on campus, representatives of students living off campus and on Central Campus, and representatives selected from the entire student body. Within the legislative branch, there are four committees (Academic Affairs; Student Affairs; External Affairs; and Buildings, Grounds, and Athletic Affairs) which initiate legislation and projects to benefit the student body. Another legislative committee, the Student Organizations Committee, is responsible for allocating the student activities fee paid by each undergraduate to various chartered clubs and organizations.

In addition to its representative role, ASDU seeks to aid every undergraduate during his/her Duke career by providing student services. These services include a free legal assistance program, a check cashing service, a maternity/abortion loan fund, a bail loan fund, a ride-rider board, babysitting and typing files, and self-defense classes.

Cultural and Social Organizations. The scope of the more than three hundred student organizations is suggested by a partial listing of their names: Alpha Phi Omega service fraternity, Black Student Alliance, Baptist Student Union, Cheerleaders, International Association, Duke Ice Hockey, Outing Club, Sailing Club, Model United Nations Club, Photography Group, and the N.C. Rural Health Coalition. Twenty-one national social fraternities and twelve national sororities are represented on campus. They are governed by the Interfraternity and Panhellenic Councils, respectively.

Many opportunities are provided on campus in the areas of music and drama. The Chorale, Modern Black Mass Choir, Chapel Choir, Wind Symphony, Marching Band, Symphony Orchestra, and Collegium Musicum are examples of musical organizations. Duke Drama provides opportunities for non-drama majors to perform established and experimental drama; Hoof 'n' Horn presents musical comedy; Karamu performs drama related to the black experience.

Several academic departments sponsor organizations and programs for students with special academic or professional interests. There are over twenty academic department majors unions on campus. There are also academic and leadership honorary societies.

Media. The *Chronicle*, the campus newspaper, publishes five issues weekly and is governed by the Chronicle Board. A weekly report of campus information (*The Guide*), a humor magazine (*Jabberwocky*), a literary magazine (the *Archive*), a special topics newspaper (*The Missing Link*), a feature magazine (*Tobacco Road*), a science magazine

(*Vertices*), a photography magazine (*Latent Image*), Duke's black literary publication (*Prometheus Black*), a journal of campus news and opinion (*Duke Blue*), and the *Duke Journal of Politics* are published on a regular basis by students. In addition, a *Teacher-Course Evaluation Book*, *The Student Guide to Duke*, *The Duke Women's Handbook*, and a comprehensive yearbook, the *Chanticleer*, are produced each year. These publications are under the direction of the Undergraduate Publications Board, which chooses the editors and business managers and reviews the financial budgets of all such franchised publications. The *DukEngineer*, the official student magazine of the School of Engineering, appears twice each year and contains articles on technical and semitechnical topics as well as other matters of interest to the school. WXDU 88.7 FM is the student-managed and programmed radio station, broadcasting to the Duke and Durham communities. Duke Union Community Television (Cable 13) is operated by students and produces color television programs that are broadcast throughout the campus on the University cable system. It also produces Yearlook, Duke's video yearbook.

Project WILD. Project WILD (Wilderness Initiatives for Learning at Duke) is a unique student organization which, through the practice of experiential education (learning through doing), attempts to ease the transition period into college for Duke students. Run entirely by students, the program strives to teach self-worth, group awareness, and an appreciation of nature. The program has three primary components. The August Course is a twelve-day backpacking expedition in western North Carolina held prior to orientation. The House Course is taught each spring semester and includes a seven-day expedition. The Ropes Course Program is a two- to four-hour experience for groups or individuals and is available to the University community year round.

Health, Physical Education, and Recreation

Besides offering a variety of classes (see the chapter "Courses of Instruction"), the Department of Health, Physical Education, and Recreation also sponsors numerous programs for all students in intramurals, sports clubs, and recreation.

The Intramural Sports Program provides an opportunity for every student to participate in organized recreation competition in forty-nine activities. The program is comprised of four major areas: men's intramurals, women's intramurals, co-rec intramurals, and recreation programs. It is open to all graduate and undergraduate students of Duke University. Participation, not skill, is a major factor that is emphasized in the program.

Thirty-two sports clubs have been chartered by Duke students for those with similar interests to participate in competition and recreational activities. Clubs vary from those which compete with clubs of other universities, such as soccer, rugby, and ice hockey, to those of a more recreational nature such as cycling, and sailing, and one which yearly presents several performances, the water ballet club.

The University's many recreational facilities, available to all students, include the championship Robert Trent Jones Golf Course, tennis courts (some lighted) on both campuses, swimming pools on both campuses, three gymnasiums, a weight training room, squash and racquetball courts, outdoor handball and basketball courts, an all-weather track, numerous playing fields, jogging trails, and informal recreational areas. Tournaments in recreational sports are often organized and conducted by students. Students may reserve facilities and equipment at designated times.

Intercollegiate Athletics

The Athletic Department fosters intercollegiate athletics by striving for excellence and by providing the best possible framework within which highly accomplished student athletes can compete. The department has a dual responsibility to provide a high-quality athletic program and environment so that all students have the opportunity to compete to the fullest extent of their abilities. Duke is a member of the National

Collegiate Athletic Association and the Atlantic Coast Conference (ACC). The ACC consists of Clemson, Duke, Florida State, Georgia Tech, Maryland, North Carolina at Chapel Hill, North Carolina State, Virginia, and Wake Forest.

The intercollegiate program for men includes football, soccer, basketball, cross country, swimming, fencing, wrestling, indoor and outdoor track, baseball, golf, tennis, and lacrosse. The women's athletic program provides intercollegiate competition in basketball, fencing, field hockey, golf, soccer, swimming, tennis, volleyball, indoor and outdoor track, and cross country. Freshmen may participate on all varsity teams.

The Director of Athletics and Associate Director of Athletics provide departmental leadership and coordinate all athletic policies with the University Athletic Council. The council consists of representatives from the undergraduate student body, the faculty, the administrative staff, the trustees, and the alumni. The council meets with the Director of Athletics periodically during the school year. The chairman of the council is the official University representative at national and conference athletic meetings.

The Duke Student Honor Commitment

"The Duke Student Honor Commitment" was proposed by the members of the class of 1982. Different from and in addition to the Judicial Code, the Honor Commitment is a personal commitment of honor and integrity which is self imposed and not enforced by an outside authority.

The commitment reads as follows:

A unique aspect of a liberal education is its attempt to instill in the student a sense of honor and high principles that extends beyond academics. An essential feature of Duke University is its commitment to an atmosphere of integrity and ethical conduct. As a student of Duke University, I accept as my personal responsibility the vigorous maintenance of high standards of honesty, truth, fairness, civility, and concern for others.

My devotion to integrity establishes that I will not cheat in academic work and that I will adhere to the established and required community code of conduct. According to the dictates of my own conscience, I will report behavior in violation of such established standards. In addition and beyond the requirements of any code or law, I confirm my own commitment to personal honor and integrity in all matters large and small. Even though the ideal of honor is an abstract one, by implementing this ideal, I join the men and women of Duke University in making the concept of honor a reality.

Judicial System and Regulations

Duke University expects and requires of all its students full cooperation in developing and maintaining high standards of scholarship and conduct. Each student is subject to the rules and regulations of the University currently in effect, or which are put into effect from time to time by the appropriate authorities of the University. At the same time, the individual is responsible for decisions and choices within the framework of the regulations of the community, as Duke does not assume *in loco parentis* relationships.

Students, in accepting admission, indicate their willingness to subscribe to and be governed by these rules and regulations. They acknowledge the right of the University to take disciplinary action, including suspension or expulsion, for failure to abide by the regulations or for other conduct adjudged unsatisfactory or detrimental to the University.

Responsibility for prescribing and enforcing rules and regulations governing student conduct rests ultimately with the Board of Trustees of Duke University and, by delegation, with administrative officers of the University. In the undergraduate schools, and in the University as a whole, many of these rules have been established over the years by cooperative action between students, faculty, and administrative officers. Representative student organizations, such as student governments and judicial boards, and more recently, community-wide bodies of students, faculty, and administrators,

have initiated proposals for policies and rules necessary to assure satisfactory standards in academic and nonacademic conduct. These proposals have been accepted by University officers and have become a substantial, if not all-inclusive, body of rules governing student life at Duke. For current regulations, refer to the *Bulletin of Duke University: Information and Regulations*.

Students in Trinity College of Arts and Sciences and in the School of Engineering constitute an undergraduate community whose members are subject to the Judicial Code of the Undergraduate Community. Violations of the code and of certain University regulations by individuals and residential or nonresidential cohesive units are adjudicated before the Undergraduate Judicial Board, composed of representatives of the student body, the faculty, and the academic administration. The Judicial Code of the Undergraduate Community, the constitution of the board, the procedural safeguards, and the rights of appeal guaranteed to students are published in the *Bulletin of Duke University: Information and Regulations* for the undergraduate community.

Student Discrimination Grievance Procedures

The Duke University policy on nondiscrimination is set forth on the credits page of this bulletin. Procedures for investigation and remedy of any complaint and for appeal of any decision are detailed in the *Bulletin of Duke University: Information and Regulations*.

Student Obligations and Requirements

Students are expected to meet academic requirements and financial obligations, as specified elsewhere in this bulletin, in order to remain in good standing. Certain nonacademic rules and regulations must be observed also. Failure to meet these requirements may result in dismissal by the appropriate officer of the University.



Admission



Principles of Selection

James B. Duke, in his Indenture of Trust, requested that "great care and discrimination be exercised in admitting as students only those whose previous record shows a character, determination, and application evincing a wholesome and real ambition for life." In this light, and in view of the institution's limited enrollment, Duke University looks beyond the basic characteristics of academic competence possessed by the majority of applicants. It seeks, in each prospective student, regardless of race, color, religion, national and ethnic origin, sex, handicap, sexual orientation or preference, or age, not only evidence of intellectual promise and maturity of judgment, but also a degree of positive energy. Often, this energy is expressed in the form of special talents and accomplishments; it is seen consistently in a student's determination to make creative use of the opportunities and challenges posed by Duke University.

Requirements for Application

As there are occasionally changes in admission policies or procedures after the printing deadline for the *Bulletin of Duke University: Undergraduate Instruction*, candidates are urged to consult the *Bulletin of Duke University: Information for Prospective Students* for specific admissions information, dates, and policies.

DEGREE STATUS

Although there are no inflexible requirements as to subject matter, students are urged to choose a broad and challenging high school program. At least twelve units of acceptable college preparatory work must be presented for review. Applicants to the School of Engineering are advised to take four units of mathematics and at least one unit of physics or chemistry.

All candidates for first-year standing must complete either the College Board Scholastic Aptitude Test (SAT) or the American College Test (ACT). Those students who choose to take the SAT should also complete three Achievement Tests, including the English Composition test (with or without essay). Applicants for the School of Engineering should also take an achievement test in mathematics (level 1 or 2). Students wishing to continue study or gain course exemption in a foreign language should complete an achievement test in that language. The SAT and Achievement Tests should be taken by

the spring of the junior year for Early Decision and by January of the senior year for Regular Admission.

Students choosing to take the ACT will not be required to submit SAT or Achievement Test scores; however, the ACT will be used for admission only, not for placement or exemption. The ACT should be taken by June of the junior year for Early Decision applicants and by December of the senior year for Regular Admission applicants.

NONDEGREE STATUS

Summer Session. Persons who are or were at the time of leaving their home institutions in good standing in accredited colleges or universities may be admitted for summer study only by the Director of the Summer Session.

Continuing Education. Admission as a continuing education student at Duke is limited to adults who live in the Triangle area; Duke graduates; persons who will be moving into the area and plan to reside here for a substantial period of time, for family and work reasons; and local high school seniors. These students are given academic counseling by the Office of Continuing Education; they are subject to most of the regulations set forth for degree candidates.

Application Procedures

DEGREE STATUS

A *Bulletin of Duke University: Information for Prospective Students* and an application may be obtained from the Office of Undergraduate Admissions, Duke University, Box 90586, Durham, North Carolina 27708-0586. A nonrefundable processing fee of \$50 must accompany the first part of the application. Students who would like to make use of the Common Application are encouraged to do so. The Common Application should be available in secondary school guidance offices.

A personal interview at Duke is not required for admission; students who find it possible to visit campus, however, may call for an interview. Area alumni interviews are also available for most applicants when Part I of the application or the Common Application has been filed by the Part I deadline. On-campus interviews cannot be granted from mid-December through May, when applications are under review.

Regular Admission. Candidates who wish to enter Duke as first-year students must submit the first part of the application by December 1 and final applications no later than January 2 of their senior year in secondary school. Decisions are mailed from the University no later than April 15, and accepted candidates are expected to reserve a place in the class by May 1 with a nonrefundable deposit of \$500.

Early Decision. Students with superior credentials for whom Duke is a clear first choice may apply for early decision. Candidates who apply for early decision are required to sign a statement confirming their commitment to enroll at Duke if they are admitted in the early decision process and to withdraw applications from other colleges and universities as soon as they learn of their admission to Duke. Secondary school counselors and parents are also asked to sign the early decision agreement.

Students applying for early decision should submit the first part of the application by October 1. Deadline for final applications is November 1. The SAT or the ACT must be taken in the spring of the junior year. Achievement Tests should also be taken in the spring since early decision applicants who have not completed their Achievement Tests may be deferred to Regular Admission. Applicants are notified of their status—admit, defer, or deny—by December 15. Admitted students pay a nonrefundable deposit of \$500 by January 5. The credentials of candidates who are deferred are considered along with candidates for Regular Admission. Deferred students are no longer bound by the

early decision agreement and are free to accept offers of admission from other colleges and universities.

This plan is designed to give well-qualified students who know Duke is their first choice a means of indicating that commitment to the University and of receiving a decision early enough to eliminate the necessity of applying to several colleges.

Midyear Admission. Midyear admission allows a limited number of students to begin their college work a semester early or to postpone matriculation for a semester. Midyear applicants are expected to complete all the requirements for fall admission. The application deadline for new candidates is September 15 for the first part of the application and October 15 for the final application; students will be notified of the decision on their applications by November 15, with the expectation that those who are accepted will reply by December 1 with a nonrefundable deposit of \$500. Midyear admission is not offered each year; interested candidates should contact the Admissions Office to see if the program is offered in the coming year.

Transfer Admission. Transfer admission from other accredited institutions may be arranged for a limited number of students each semester. Because the transcript of at least a full year of academic work is preferred by the Admissions Committee, and because transfer students are required to spend their last two years at Duke, most candidates apply to Duke preceding or during their second year of college. Candidates submit official transcripts of all work completed at other accredited colleges, high school records, scores on the Scholastic Aptitude Test, and employment records if there has been an extended period of employment since graduation from secondary school, along with completed application forms. See the section on transfer credit in the chapter "Academic Procedures and Information." On-campus housing is not guaranteed for transfer students.

September (fall semester) transfer students meet a March 1 deadline for the first part of the application and an April 1 final application deadline, learn of their decisions by May 15, and respond to the University by June 1 with a nonrefundable deposit of \$400 or \$500, if housing is requested. January transfer students submit the first part of the application by September 15 and final applications by October 15, learn of their decisions by November 15, and reply to the University by December 1.

NONDEGREE STATUS

Summer Session. Application forms and schedules of courses may be obtained by writing or calling the Office of the Summer Session, 121 Allen Building, Duke University, Durham, North Carolina 27706, (919) 684-2621. No application fee is required.

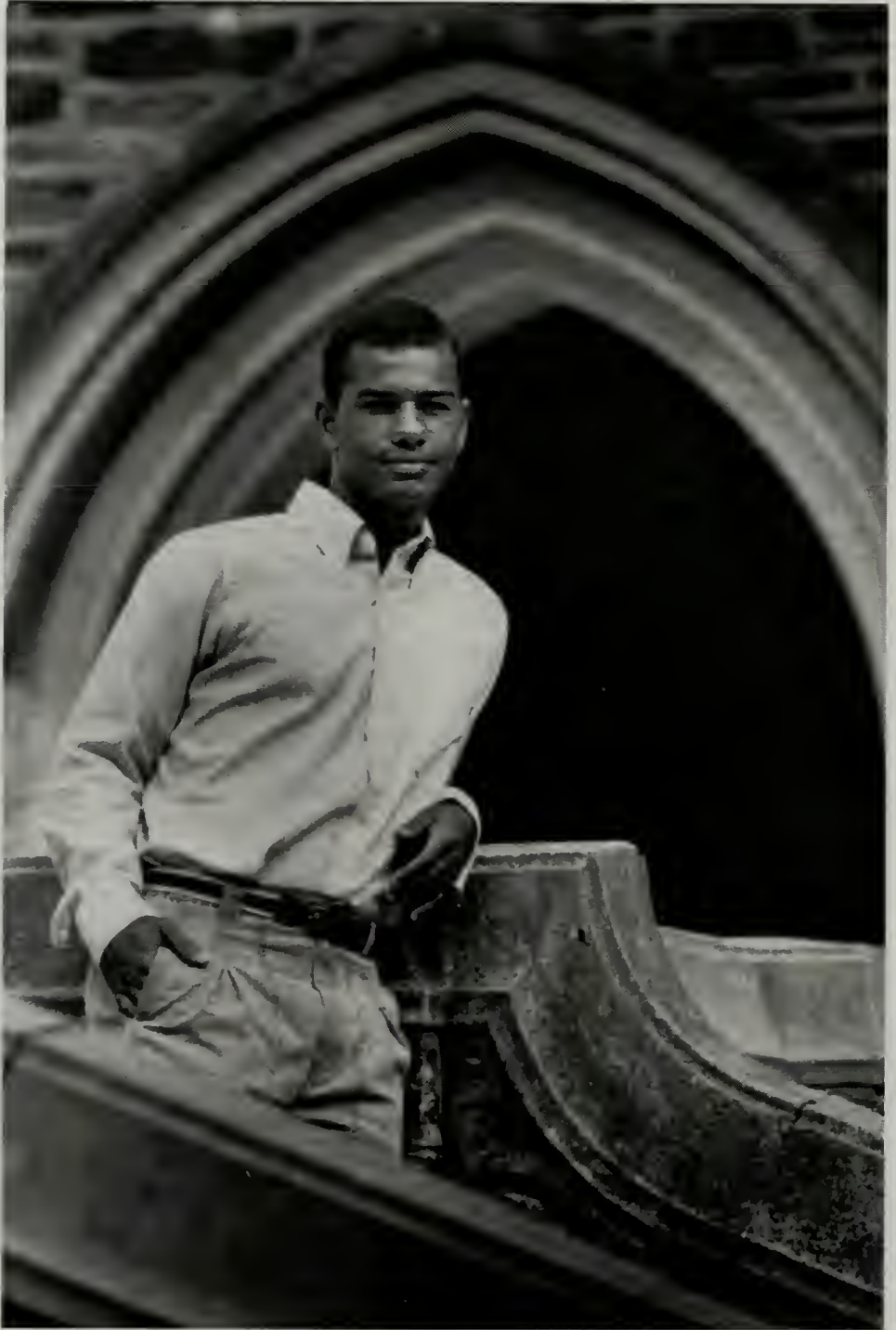
Continuing Education. Applications may be obtained from the Office of Undergraduate Admissions and must be returned to that office, accompanied by a \$35 application fee, by August 1 for the fall semester and by December 1 for the spring semester.

A certain grade point average over four courses must be attained before a nondegree student may apply for degree candidacy. More detailed information on nondegree course work through Continuing Education is available from the Office of Continuing Education, The Bishop's House, Duke University, Durham, North Carolina 27708.

READMISSION OF FORMER STUDENTS

A student who desires to return, following withdrawal from college, should apply to the appropriate college or school. (See the section on readmission procedures in the chapter "Academic Procedures and Information.")

Financial Information



Tuition and Fees*

No college or university can honestly state that an education at the college level is inexpensive. Fees paid by students cover less than half the cost of their instruction and the operation of the University. Income from endowment and contributions from alumni and other concerned individuals meet the balance and assure each student the opportunity to pursue an education of unusually high quality.

Students are urged to give their attention first to the selection of institutions which meet their intellectual and personal needs, and then to the devising of a sound plan for meeting the cost of their education. This process will require an in-depth knowledge of both the University's financial aid program and the resources of the student's family. A brochure describing in detail the various forms of financial aid may be obtained from the Office of Undergraduate Financial Aid, Duke University, Durham, North Carolina 27706.

Estimated Expenses.* Certain basic expenditures, such as tuition, room, and board, are considered in preparing a student's budget. These necessary expenditures, with a reasonable amount allotted for miscellaneous items, are shown below:

	<i>Academic Year, 1993-94</i> (two semesters)	<i>Two Summer Terms, 1993</i> (one semester equivalent)
Tuition		
Trinity College	\$16,720	\$4,824-5,628
Engineering	\$17,810	\$4,824-5,628
Residential Fee		
Single Room	\$3,322-4,361	\$1,523
Double Room	\$2,498-3,287	\$761
Food		
100% board plan	\$3,070	\$1,186
75% board plan	\$2,520	\$980
Books and Supplies	\$590	\$280
Student Health Fee	\$356	\$110

It should be realized that additional expenses will be incurred which will depend to a large extent upon the tastes and habits of the individual. The average Trinity College student, however, can plan on a budget of approximately \$24,350. The budget estimate for the summer (two terms, one semester equivalent) is \$7,780. These budgets are all-inclusive except for travel costs and major clothing purchases.

*The figures in this section are projections and are subject to change.

Registration Fees and Deposits for Fall and Spring. On notification of acceptance, students are required to pay a nonrefundable first registration fee of \$40 and to make a deposit of \$460. The deposit will not be refunded to accepted applicants who fail to matriculate. For those who do matriculate, \$100 of the deposit serves as a continuing residential deposit for successive semesters, and the remaining \$360 serves as a continuing registration deposit.

Late Registration. Continuing students who fail to register during the registration period must pay a fee of \$50 to the Bursar.

Part-Time Students. In the regular academic year, students who register for not more than two courses in a semester are classified as part-time students. Part-time students will be charged at the following rates: one course, \$2,090 (for engineering, \$2,226.25); half course, \$1,045 (for engineering, \$1,113); quarter course, \$522.50 (for engineering \$556.50). Registration for more than two courses requires payment of full tuition. Graduate students registered for undergraduate courses will be assessed three units for nonlaboratory courses and four units for laboratory courses. Men and women in nondegree programs who are being considered for admission to degree programs, as designated by the Office of Continuing Education, pay fees by the course whether the course load is one, two, or three courses.

Auditing one or more courses without charge is allowed for students paying full fees, provided that the consent of the instructor is obtained. Students who are enrolled for one or two courses may audit other courses by payment of \$209 (\$224 for engineering) for each course audited. With the consent of the appropriate instructor and the Director of Continuing Education, graduates of Duke may audit undergraduate courses for the above payment per course.

Payment of Accounts for Fall and Spring. The Office of the Bursar will issue invoices to registered students for tuition, fees, and other charges approximately four to six weeks prior to the beginning of classes each semester. The *total amount due* on the invoice is payable by the invoice late payment date which is normally one week prior to the beginning of classes. Inquire at the Bursar's Office, (919) 684-3531, if an invoice has not been received three weeks prior to the first day of classes, so that payment can be forwarded while a duplicate invoice is issued to document the balance owed. *As part of the admission agreement to Duke University, a student is required to pay all invoices as presented.* If full payment is not received, a late payment charge as described below will be assessed on the next invoice and certain restrictions as stated below will be applied. Failure to receive an invoice does not warrant exemption from the payment of tuition and fees nor from the penalties and restrictions. Nonregistered students will be required to make payment for tuition, fees, required deposits, and any past due balance at the time of registration.

Multiple Payment Plan. The Multiple Payment Plan allows students and their parents to pay part or all of the annual financial obligations for tuition, room, and board in nine equal installments. An annual nonrefundable participation fee is charged, but no interest is charged. The initial payment is made by check and subsequent payments are made by bank drafts. The deadline for participation in the Multiple Payment Plan is June 15 for fall semester. Questions regarding this plan should be directed to the Office of the Bursar, 101 Allen Building, (919) 684-3531.

Guaranteed Tuition Plan. The Guaranteed Tuition Plan offers undergraduate freshmen who are not recipients of University supported financial aid and their parents the opportunity of paying four years of tuition in forty-four installments. The tuition is guaranteed at the freshmen fall semester rate and financed at a set rate of interest. The initial payment is made by check and subsequent payments are made by bank drafts. The deadline for participation in the Guaranteed Tuition Plan is June 15. Questions regarding this plan should be directed to the Office of the Bursar, 101 Allen Building, (919) 684-3531.

Duke University Prepaid Tuition Plan. The Duke University Prepaid Tuition Plan offers undergraduate freshmen who are not recipients of University-supported financial aid and their parents the opportunity of paying four years of tuition in one lump sum. This plan guarantees tuition charges for four years of undergraduate study at the freshman rate. Room, board, summer school tuition, and other university charges are not covered. To qualify, both parents and student must sign the contract and make payment for four years tuition plus a \$100.00 nonrefundable participation fee to the Office of the Bursar. The deadline for participation in the Prepaid Tuition Plan is July 1 of the enrolled student's freshman year. Questions regarding this plan should be directed to the Office of the Bursar, 101 Allen Building, (919) 684-3531.

Late Payment Charge. If the total amount due on an invoice is not received by the invoice late payment date, the next invoice will show a penalty charge of 1 1/4 percent per month assessed on the past due balance regardless of the number of days past due. The past due balance is defined as the previous balance less any payments and credits received on or before the late payment date and also any student loan or scholarship memo credits related to the previous balance which appear on the invoice.

Restrictions. An individual will be in default of this agreement if the total amount due on the student invoice is not paid in full by the invoice late payment date. An individual who is in default will not be allowed to register for classes, receive a copy of the academic transcript, have academic credits certified, be granted a leave of absence, or receive a diploma at graduation. In addition, an individual in default may be subject to withdrawal from school.

Tuition and Fees for Summer Session. Tuition for undergraduates is \$1,206 for each nonlaboratory or 3 semester hour (s.h.) course, \$1,608 for each laboratory or 4 s.h. course, \$804 for each half course (2 s.h.), and \$2,412 for each one and one-half course program (6 s.h.) offered at the Marine Laboratory.

Tuition for graduate students taking an undergraduate course is as indicated above.

Health Fee. All Duke students and all full-time non-Duke students are required to pay \$55 per term. All students at the Marine Laboratory are required to pay \$47 per five-week registration period.

Music Fee. A fee of \$135 will be charged for Music 81 and 85. A fee of \$270 will be charged for Music 91 and 95.

Auditing Fees. With permission of the instructor and the Director of the Summer Session, students registered for a full course program (two courses) may audit one nonlaboratory course except a physical education and dance activity course, a studio art course, an applied music course and foreign programs. No extra charge is made.

Students carrying less than a full course program may be granted permission by the instructor and the Director of the Summer Session to audit a course (the above exceptions apply) but must pay half the University fee for the course.

Late Fee. Students who fail to register and pay all tuition and fees before five full working days prior to the first scheduled class day of a given course will pay an extra charge of \$25.

Payment of Tuition and Fees. The University does not mail statements for summer session tuition and fees. All summer tuition and fees (which students must calculate from the information above) and any past due balance should be paid in the Office of the Bursar (101 Allen Building) at least five full working days prior to the first day of class (see Summer Session calendar). Students paying by mail may forward payment to the Office of the Bursar, 101 Allen Building, Duke University, Durham, North Carolina 27706. Students who fail to pay tuition and fees and/or otherwise fail to clear with the Bursar by the end of the drop/add period will be withdrawn from their courses. These withdrawn students will be billed the health fee and an administrative withdrawal fee of \$150 per course (\$75 per half-course) for which they were registered. (See the section on Refunds and Administrative Withdrawal Charges concerning penalties in this chapter). Students who, subsequent to withdrawal, clear with the Bursar may, with written

permission of their academic dean, be reinstated in their classes as originally registered. The administrative withdrawal fee will stand and the student will be liable for full tuition and fees. Students who are unable to meet these deadlines should consult with the Bursar and their academic dean prior to the deadline.

Transcripts. Requests for transcripts of academic records should be directed to the Associate Registrar. Ten days should be allowed for processing. A fee of \$3, payable in advance, is charged for each copy.

Duke Employees. With the permission of their supervisors, employees may, through the Office of Continuing Education, take up to two courses for credit or audit during any one semester or one during a summer term. A formal application for credit course work must be submitted by August 1 for the fall semester or December 1 for the spring semester. No formal application is required for auditing. Half-time employees with one or more years of service who receive permission to take such courses will be charged one-half the tuition rate shown above for part-time students during the fall and spring and one-half of the summer tuition rate. This benefit applies only to nondegree work. Full-time (thirty or more hours a week) employees with two or more years of service who receive permission to take such courses will be charged one-tenth the tuition rate for credit course work and will be permitted to audit at no charge. This benefit continues after degree candidacy has been attained. Eligible employees should consult the Benefits Office, 705 Broad Street (919) 684-6723, at least one week in advance of payment date to obtain the appropriate tuition voucher. The Director of Continuing Education is available to advise Duke employees on educational matters (919) 684-6259.

Living Expenses*

Housing for Fall and Spring. In residence halls for undergraduate students the housing fee for a single room ranges from \$3,322 to \$4,361 for the academic year; for a double room, the fee ranges from \$2,498 to \$3,287 per occupant.

To reserve University housing for the fall semester, returning students who are eligible for and wish to occupy such housing must make a \$50 prepayment of the housing fee at a designated time during the spring semester.

Detailed information concerning the student's obligations under the housing contract and the consequences of failure to comply are published in the *Bulletin of Duke University: Information and Regulations*.

Housing for Summer. For detailed information on types and costs of accommodations available at Duke University for the summer session write: Department of Housing Management, 218 Alexander Avenue, Apartment B, Durham, North Carolina 27705.

Food and Other Expenses. Duke Dining Services and Duke University Store operations are located on campus to serve the needs of the Duke community. The University identification card, known as THE DUKECARD, can be used to gain access to prepaid accounts and make purchases in many Duke University facilities.

There are two accounts: the dining account, used to purchase food items in Duke Dining Services and Duke Stores operations; and the flexible spending account, used to purchase any goods or services from Dining Services, Duke Stores, and other operations.

*The figures contained in this section are projections and are subject to change prior to the beginning of the fall 1993 semester.

to \$1,535 per semester. The flexible spending account is optional and may be set for \$50 or more.

Information regarding these accounts is sent to matriculating students. For more information about campus retail and food facilities, see the chapter "Campus Life" in this bulletin.

Fall and Spring Refunds

In the case of withdrawal from the University, students or their parents may elect to have tuition refunded or carried forward as a credit for later study according to the following schedule:

Withdrawal	Refund
Before classes begin	Full amount
During first or second week	80 percent
During third, fourth, or fifth week	60 percent
During sixth week	20 percent
After sixth week	None

Tuition charges paid from grants or loans will be restored to those funds on the same pro rata basis and will not be refunded or carried forward. In the event of death, a full tuition, fees, and residence hall refund will be granted. In case of a call to military service, a full semester's tuition, full purchase price of textbooks from the University's book store, and the pro rata amount of the room charge will be refunded. The outstanding balance of the food service plan will be refunded in case of military service or death.

In the case of dropping special fee courses (e.g., music, art, golf), or of part-time students dropping audit courses, a full refund will be granted students during the drop-add period. Students changing status to part-time are required to request permission at the time of preregistration; therefore, no refunds are granted during the drop/add period or subsequently for changes which involve carrying less than a full-time load.

The registration deposit will be refunded to students whom the University does not permit to return, who graduate, or who request the refund prior to registration, thereby indicating their intention not to return for the following semester. The registration deposit will not be refunded to students who register for the following semester but fail to enter. Arrangements for refund of the \$100 residential deposit are described in the housing contract.

The remaining balance is any registration deposit applicable to a graduated student who did not reside on campus in the semester preceding graduation will be refunded within four weeks following graduation. The remaining balance of both housing and registration deposits applicable to a graduated student who did reside on campus in the semester preceding graduation will be refunded within seven weeks following graduation.

Summer Administrative Withdrawal Charges and Refunds*

Drop or Administrative Withdrawal Charges. Students who will not be attending a summer term or course for which they have registered (i.e., have scheduled a course through the telephone registration system) must officially drop the course(s) prior to the beginning of the term whether or not they have paid tuition and fees. (See the section on course changes for the summer term in the chapter "Academic Procedures and Information.") Students who fail to drop the course(s) prior to the beginning of the term will be charged \$150 per course (\$75 per half-course) plus the health fee.

*This policy does not apply to foreign program students.

Refunds (Except Foreign Programs). Students who will not be attending a summer term or course for which tuition and fees have been paid are eligible for refunds following these policies:

1. There is no refund of tuition and fees if the student drops a course(s) or withdraws from the term after the third day.
2. Full tuition less \$150 per course (\$75 per half-course) is refunded if the student officially drops a course(s) or withdraws from the term during the first three days. The health fee is not refunded. (There is no charge for drop/adds that result in no change in course load in the same term.)
3. Full tuition and fees are refunded if the student officially drops a course(s) or withdraws from the term before the first day.

Student Aid

Duke University is strongly committed to its financial aid program and for the four years of undergraduate enrollment will meet 100 percent of the demonstrated need of each eligible admitted student. The University's aid program includes both merit and need-based scholarships, work-study, the Federal Pell grant program, the Federal Perkins Loan (formerly National Direct Student Loan Program), and the Federal Stafford Student Loan Program (formerly Guaranteed Student Loan Program). Since admissions decisions are made without reference to a student's application for aid, students needing assistance are strongly encouraged to apply for financial aid at the same time as for admission. Students receiving financial aid will be notified at the same time that they are offered admission.

For the student with demonstrated need, the net cost of an education at Duke University will generally be no greater than that for attendance at any college or university. It is the intention of the Office of Undergraduate Financial Aid to set each award at a level consistent with a student's ability to meet the costs of attending Duke University. This will be done by taking into consideration the contribution that can reasonably be expected from the student, the family, and any available outside sources. During the current academic year, over forty percent of the student body receives more than twenty-one million dollars in aid of various types.

Financial Aid for Entering Freshmen. Candidates should initiate their application for financial aid concurrently with their application for admission during the fall semester of their senior year in secondary school. Instructions concerning the specific requirements and deadline dates will accompany application materials. The Financial Aid Packet (which includes both the Free Application for Federal Student Aid (FAFSA) and the Financial Aid Form (FAF)) must be submitted to the College Scholarship Service. In divorce cases, the University requires both parents to submit financial information. The custodial parent should submit an FAF. The noncustodial parent can submit the Divorced/Separated Parents Statement which may be obtained from either the high school guidance office or the Financial Aid Office. A copy of all pages, including schedules and attachments, of both parents' and student's current federal income tax form must be submitted to the Financial Aid Office on or before May 1. Information provided on the FAF will be verified through the use of the tax return.

Financial aid recipients wishing to operate a motor vehicle on campus must first register it with the Financial Aid Office. As an automobile represents an asset, the value of a financial aid recipient's car will be considered in the estimation of a student's need. As a general rule, a student's annual contribution will be increased by 35 percent of the value of the car.

Renewal of Financial Aid after the Freshman Year. Each year students must file an application for renewal of financial aid. This application must include a new Financial Aid Form and a copy of all pages, including schedules and attachments, of the parents'

and student's current federal income tax return. Application packets may be picked up in the Financial Aid Office in mid-December. The deadline for applications is April 16. Failure to meet this deadline may affect the type and amount of aid offered. All qualified students may receive need-based aid for up to eight semesters. Under certain circumstances consideration will be given to a ninth semester of eligibility.

To have financial aid renewed, a student must meet the continuation requirements outlined on pages 23, 24, and 35, as appropriate. Students not qualifying for financial aid due to their inability to meet these requirements may appeal directly to the Financial Aid Office. Students holding merit scholarships are required to maintain an average considerably higher than the minimum required for need-based financial aid recipients. Specific details regarding retention standards are outlined on page 106 and will be provided to scholarship winners.

Summer School Financial Aid. Financial aid is generally available for each summer session. Interested students can obtain specific details as to available funding and an application through the Financial Aid Office in March of each year.

Types of Financial Aid. Gift scholarships or grants, long-term loans, and employment are integral parts of the financial aid program, and some portion of the aid offered an undergraduate is normally in each of these forms.

The work-study opportunity and loan(s) offered as financial aid are considered to be the self-help portion of the award. The standard aid package at Duke provides that the first \$1,700 to \$5,000 of each student's need be awarded in the form of self-help funds. Funds awarded in excess of this amount will generally be grant funds. This combination of University grant funds and opportunities for self-help enables Duke to extend its resources to a larger number of deserving students.

Duke has a number of scholarships based on merit which are available from personal endowments and corporations. Most are intended for entering freshmen, whereas a few are awarded to upperclass students. These scholarships may be based on achievement in a particular field or on an outstanding overall record.

Gift Scholarships. The following are among the named gift scholarships offered through Duke University. Where specified, these scholarships are renewable for four (4) years of undergraduate study for those students meeting the following academic standards:

Renewable merit scholarships will be continued for freshmen who complete the first year of studies with a 2.8 average or higher. Upperclass students must complete each academic year with a 3.0 average or higher. Students failing to meet these standards will be placed on probation for one semester during which they must maintain a 3.0 average or higher. Failure to maintain a 3.0 average or higher in subsequent semesters will lead to cancellation of the scholarship.

Angier B. Duke Memorial Scholarships. The Angier B. Duke Memorial Scholarships, competitively awarded on the basis of academic merit, have been established to encourage the intellectual achievement of men and women by recognizing those who possess outstanding academic and leadership abilities. Candidates are selected on the basis of intellectual performance, creative talent, and promise of being eventual leaders in whatever field of endeavor they choose. The scholarship is a four-year program (eight semesters), and a student's continuation in the program is contingent upon good academic performance. All 1992-93 freshman scholarship holders received \$15,700 if enrolled in Trinity College of Arts and Sciences, and \$16,725 if enrolled in the School of Engineering. Students demonstrating additional need will receive a grant from Duke University funds up to the amount needed. All Angier B. Duke Scholars participate in a six-week summer study program at Oxford University in England after the junior year. Under the Oxford program the scholarship pays tuition, single room accommodation, full board, designated excursions for all scholars, and an allowance for transatlantic air fare between New York and London. Those choosing not to participate in the Oxford program are eligible for a \$2,000 grant for an approved independent project. At least one of the four years of the scholarship could be used abroad on an approved program.

W. N. Reynolds Memorial Scholarships. Recipients of these awards are students with outstanding ability and/or need who show promise of constructive leadership. In considering candidates for the

awards, consideration will be given in the following order: (1) children of employees of R. J. Reynolds Tobacco Company or any of its affiliates or subsidiaries; (2) children of families residing in Forsyth County, North Carolina; and (3) other candidates who are residents or natives of North Carolina. There are a number of awards available for each freshman class with a minimum value of \$500.

A. J. Fletcher Scholarships. These music department scholarships are given to students who can demonstrate, by tape or audition, talent and achievement in instrumental or vocal performance. These awards are at least \$750 per year and are renewable annually for up to four years. Although recipients are not required to major in music, they are required to study privately and to participate in departmental performing groups.

Lionel Hampton Scholarship. This award of \$500 (not renewable) is given to an incoming freshman who demonstrates high proficiency in a musical instrument and strong potential in jazz performance.

United Methodist Scholarships. A number of United Methodist Scholarships are available on a basis of demonstrated need to Methodist students who have given evidence of leadership in their local Methodist Youth Fellowship groups.

Alice M. Baldwin Scholarships. One or more of these scholarships, varying in amount from \$500 to \$2,500, are awarded to women who are rising seniors in Trinity College of Arts and Sciences on the basis of scholarship, character, leadership, and need.

Panhellenic Scholarship. A scholarship of approximately \$1,000 is awarded to an upperclass woman in Trinity College of Arts and Sciences on the basis of scholarship, character, leadership, service, and need.

J. A. Jones Memorial Scholarships. These scholarships, sponsored through the Jones Fund for Engineering, are awarded to engineering students whose outstanding academic and personal qualifications suggest that they will become leaders in a technological society. The awards range from \$1,000 to \$3,000, depending on each recipient's financial need.

Robert H. Pinnix Scholarships. The Robert H. Pinnix Scholarships are awarded annually to two upperclassmen enrolled in the Duke School of Engineering. The award is based upon demonstrated ability, excellence in engineering, and financial need.

Richard Miles Thompson Scholarships. The Richard Miles Thompson Scholarships are awarded annually to two upperclass students enrolled in the School of Engineering. The awards are based upon academic merit and demonstrated financial need.

The Mary Duke Biddle Scholarship in Music Composition. This scholarship with a stipend of \$3,500 per year is available to a member of each entering class. It is renewable annually as long as the student meets the required standards for renewal. Students wishing to apply for this award will be required to submit examples of their composition. Eligibility is limited to students planning to major in music.

Air Force ROTC College Scholarship Program. Students can apply for three-year scholarships during their freshman year and two-year scholarships during their sophomore year. Scholarships are available to students who qualify for flight training and to students who major in certain scientific or engineering fields. The scholarships include tuition, fees, and textbook reimbursement, plus a \$100 per month tax-free allowance.

Army ROTC Scholarship Program. All freshman and sophomore students are eligible to apply for Army ROTC scholarships. Awarded without regard to academic major, these grants pay tuition, fees, and textbook/equipment costs in addition to providing a tax-free monthly stipend of \$100 for the balance of the student's normal period to graduation. Commissioned service, following graduation, can be either on active duty or with the reserve forces. Additional information concerning Army ROTC scholarships is available from the professor of military science.

Navy ROTC College Scholarship Program. This program provides for up to four years' tuition and textbooks, laboratory fees, and a \$100 per month stipend. These scholarships, based upon academic achievement, leadership potential, and overall performance, can be awarded at any stage of the student's college career through either a nationwide selection process or by the Professor of Naval Science at the University. In addition, two other two-year scholarships are available to rising juniors: one leads to a career in nuclear power, and the other follows a summer attendance at the Naval Science Institute at Newport, Rhode Island. For further information on any of the above scholarship programs, contact the professor of naval science.

The Huguenot Scholarship. One scholarship of \$1,000 per year is available from the Huguenot Society of America to a descendant of a Huguenot.

Reginaldo Howard Scholarships. These scholarships, awarded annually to freshman minority students, are provided to honor the late Reggie Howard, first black president of the student government. Seven scholarships for \$6,000 are awarded each year. Scholarships are available for the four years of undergraduate study as long as the student maintains the academic average specified for renewal.

The Anne McDougall Memorial Award. The Anne McDougall Memorial Award for Women is awarded each year to one woman student studying psychology or a related field. Administered through Women's Studies, this \$1,000 award is intended to provide encouragement and support for women who wish to pursue academic study and continue in the area of human service.

Alumni Endowed Scholarships. Three \$8,000 per year Alumni Endowed Undergraduate Scholarships are awarded to students who demonstrate superior academic ability and leadership potential. These awards are renewable annually for those meeting the stated requirements. Although not restrictive, preference is given to children of alumni.

Scholarships for North Carolina Residents

The Benjamin N. Duke Scholarship Fund. Established by the Duke Endowment to honor Benjamin N. Duke, this fund is intended to encourage the enrollment of students from North Carolina and South Carolina.

The Benjamin N. Duke Leadership Award. As part of the Benjamin N. Duke Scholarship Fund, these awards recognize and encourage leadership potential and community involvement of students from North and South Carolina. Ten scholarships, valued at 75 percent of tuition, are awarded annually.

The Benjamin N. Duke Scholarship Fund also provides a number of grants which replace what would normally be the loan portion of need-based awards received by students from North Carolina and South Carolina. This fund can allow need-based aid recipients from the Carolinas to graduate debt free following the eight standard semesters of enrollment.

Trinity Scholarships. Awarded to North Carolinians of exceptional ability, these scholarships are named to honor the fact that Duke University was originally named Trinity College. Trinity scholarships provide each winner an award equal to the value of tuition, fees, room, board, and the cost of a summer program.

North Carolina Math Contest. Upon enrolling at Duke, the top student finishing in the top ten in the North Carolina Math Contest taken as a high school senior is eligible to receive a scholarship equal to the amount of tuition. This scholarship is available for each of the four years of undergraduate enrollment as long as the student maintains the specified average. Winners must have applied to and been accepted by Duke University.

The Perry Family Scholarship. Awarded to students from Winston-Salem and the Forsyth County area, this scholarship, valued at \$5,000, is awarded every other year. Recipients of the scholarship will be required to demonstrate high academic achievement as well as leadership and/or involvement in extracurricular activities. The scholarship is available for four years if the student meets the specified academic requirements.

J. Welch Harriss Scholarships. Recipients of these scholarships will receive \$1,000 per year without reference to need. If demonstrated need exceeds \$1,000, then the scholarship will be adjusted accordingly. These awards are made to entering freshmen who have achieved outstanding academic records. They are renewable each year as long as the student maintains the required average. Consideration will be given in the following order: (1) students from High Point, North Carolina; (2) students from Guilford County, North Carolina; and (3) students from North Carolina.

Alyse Smith Cooper Scholarships. Each year six or more scholarships of various amounts are awarded to students demonstrating both merit and need. Preference is given to students from Alamance County, North Carolina.

Braxton Craven Endowed Scholarships. Recipients of these scholarships will receive an amount equal to the current tuition at Duke. Braxton Craven scholars will be chosen on the basis of outstanding academic and extracurricular achievement and need. First preference is given to students from North Carolina. The scholarships are approved on a continuing basis, provided that the recipient complies with the specified academic requirements.

The John M. and Sally V. Blalock Beard Scholarship. These scholarships are awarded annually to outstanding students from the Wake County area of North Carolina who major in English or the History of the United States. These awards are based on financial need, scholarship, character, and academic achievement.

North Carolina Legislative Tuition Grant. The North Carolina General Assembly has established a program of tuition grants available to North Carolina residents who are full-time students at private colleges and universities in the State of North Carolina. The grant for each eligible student is approximately \$1,150 per year. Applications will be mailed to all eligible students during the summer. In the case of a need-based financial aid recipient, this grant reduces a student's tuition and therefore his budget. All qualified need-based aid recipients are required to apply for this grant.

State Contractual Scholarships for Needy North Carolinians. Funds provided by the State of North Carolina through the Legislative Grant Program are distributed to needy North Carolinians qualifying

for the State Contractual Scholarship Program. Application is made through the College Scholarship Service's Financial Aid Form.

Employment. Duke University offers subsidized employment opportunities to many students not qualifying for need-based financial aid. Interested students should submit the Financial Aid Form to the College Scholarship Service.

Loans. The loan programs which are available to students through Duke University are listed below:

Federal Perkins Loan. Loan funds supplied by the federal government and Duke University through Part E of Title IV of the Higher Education Act of 1965 are available to qualified students. Repayment of loans under this act normally begins nine months after the student is graduated or leaves college, with complete payment scheduled within a ten-year period. Interest accrues at the rate of 5 percent annually, commencing nine months after the borrower ceases to be at least a half-time student at an institution of higher education. This loan is part of the student's financial aid award.

Federal Stafford Student Loan Program. Loans under the Federal Stafford Student Loan program are available from banks or other incorporated state lending agencies. Duke University can arrange an alternate lender for students who are unable to obtain these loans through their home state agencies or local banks. Need as established by the federal government's formula will be considered in the University's decision regarding applications. The annual limit on a loan, which has a variable interest rate that is capped at 9 percent, is \$2,625 for freshmen, \$3,500 for sophomores, and \$5,500 for juniors and seniors. Repayment begins six months after the student leaves school.

Students may apply for Stafford loan funds by submitting a loan application directly to the Financial Aid Office. In addition, loan applicants must submit the Free Application for Federal Student Aid to the College Scholarship Service. Additional information about this loan program may be obtained from the Undergraduate Financial Aid Office.

Federal Parents' Loan for Undergraduate Students Program. Parents may borrow up to the cost of education less financial aid through the Federal Parent Loan for Undergraduate Students (PLUS) program. Repayment of these loans begins sixty days after loan disbursement. Interest is based upon treasury bill rates but will be no higher than 10 percent and begins to accrue at the point repayment begins. Interested parents should contact their home state lending agency or the financial aid office.

Federal Supplemental Loans for Students. Under the Federal Supplemental Loans for Students (SLS) Program, undergraduate students are eligible to borrow up to \$4,000 during their freshman and sophomore years and \$5,000 during their junior and senior years at an interest rate capped at 11 percent. Repayment of the principal begins after the student is out of school six months, while interest payments are not deferred and are paid quarterly.

Share Loans. "Share" is a supplemental educational loan program developed specifically to help families meet the costs of higher education. Credit-worthy families, regardless of income, may be eligible to borrow through this program. Annual loan amounts range from \$2,000 to \$20,000 per year with a cumulative borrowing limit of \$80,000. The interest rate is variable, and Share offers several repayment options.

Children of Methodist Ministers. Children of ministers in the North Carolina and the Western North Carolina Annual Conferences of the United Methodist Church may be eligible to receive a partial tuition grant of \$750 per semester for a maximum of eight semesters of undergraduate study at Duke University. Eligibility is met by the parent being in a regular pastoral appointment and resident in one of the conferences. When the parent is in a special appointment and resident in one of the conferences, eligibility will be determined on an individual basis, depending upon the nature of the appointment. In all cases the decision of the University will be final.

Employment. Most financial aid recipients are offered a job as part of their aid package. These jobs require between ten and fifteen hours a week and provide an average stipend of \$1,700. The money is paid directly to the student. The Office of Undergraduate Financial Aid maintains part-time employment listings for the campus and Durham area. All students interested in working during the school year should inquire at Student Employment in the Financial Aid Office at the beginning of the semester. Every effort will be made to help students find jobs consistent with their interests.

Duke University also expects that students receiving financial aid will work during the summer. In the year before entering college, a freshman should save a minimum of

\$1,400 for use during the first year of college. In subsequent years, minimum student earnings will be \$1,700 for sophomores, \$1,800 for juniors, and \$1,900 for seniors. These figures are viewed as estimates and are revised consistent with actual earnings.

Financial Plans. There are three plans available to assist parents and students in fulfilling financial obligations. More information about each described can be obtained from the Office of Undergraduate Financial Aid.

Tuition Plans. Many families finance a college education with the assistance of an insured tuition payment plan regardless of whether they receive financial assistance from Duke. Although these plans are sponsored by a number of private firms, the University refers parents to plans provided by the Richard C. Knight Insurance Agency, Inc. The company provides the University with the full sum required each semester and arranges a schedule for monthly repayment by the subscribing families. The schedules for repayment vary with the program offered by the company. Additional information on this particular tuition payment plan may be obtained by writing to Richard C. Knight Insurance Agency, Inc., Insured Tuition Payment Plan, 53 Beacon Street, Boston, Massachusetts 02108.

Tuition payment plans are also available through the Tuition Plan, Concord, New Hampshire 03301. Each year the Tuition Plan will send information to all students.

Payment Plans. The University is pleased to offer a number of payment plans. These include a nine-month plan and a plan by which tuition for four years is locked in at the freshman rate. Interest is established annually with payments being made in forty-four equal installments.

Additionally, parents may pay four years of tuition, using the freshman rate, at one time. Details of these programs will be forwarded to students at the time of admission.

Loan Plans. Duke is pleased to offer loans through the Duke University Family Loan Plan and A Better Loan for Education (ABLE) plan. These two separate University loan plans offer different terms but allow families to extend payments over as long as fifteen years.

Of additional assistance is the SHARE Loan Program. Using this program, parents may borrow between \$2,000 and \$20,000 annually to meet their children's costs of education. Repayment may be made over twenty years.

Courses of Instruction



Definition of Terms

Courses taught in 1991-92 or in 1992-93 or scheduled for 1993-94 are included in this chapter with full descriptions. Additional courses, which were taught prior to 1991-92 and are likely to be taught in the future, are listed separately by number and title only under the heading *Courses Currently Unscheduled*. For courses which will be offered in 1993-94, consult the *Official Schedule of Courses*.

Introductory level courses are numbered below 100; advanced level courses are numbered 100 and above. Courses numbered 1 through 49 are primarily for first-year students; courses numbered from 200 through 299 are primarily for seniors and graduate students. (See the section on course load and eligibility in the chapter "Academic Procedures and Information.")

Odd-numbered courses are usually offered in the fall semester, even-numbered courses in the spring semester. Double numbers separated by a hyphen indicate that credit is contingent upon completion of both courses. Double numbers separated by a comma indicate that although the course is a year-long course, credit may be received for either course or both courses.

The following symbols, suffixed to course numbers, identify the small group learning experiences: *S*, seminar; *P*, preceptorial; *T*, tutorial; *D*, discussion section. The *L* suffix indicates that the course includes laboratory experience. *C-L* denotes a course that is cross-listed or a program under which a course is listed.

The following symbols, suffixed to course titles, identify the area of knowledge to which a particular course has been assigned in the curriculum: *AL*, arts and literatures; *CZ*, civilizations; *FL*, foreign languages; *NS*, natural sciences; *QR*, quantitative reasoning; *SS*, social sciences.

The following portion of this bulletin, arranged alphabetically, includes courses of departments, programs, sections, and institutes, as well as categories of courses. Details are provided in the individual entries, which indicate whether a major is available in that particular field. A certificate, offered in some programs, is not a substitute for a major but is a supplement, confirming that a student has satisfied the requirements of that program.

Trinity College of Arts and Sciences

Professor White, *Dean of Trinity College and Vice Provost for Undergraduate Education*; Senior Associate Dean for Administration Wilson (Social Sciences); Associate Deans Bryant (Social Sciences), Nijhout (Natural Sciences), and Wittig (Humanities); Assistant Deans Johns (Study Abroad), Lattimore (Social Sciences), Ruderman (Summer Sessions), and Singer (Natural Sciences)

Aerospace Studies—Air Force ROTC (AS)

Professor Rowe, Colonel, USAF, *Chair*; Visiting Assistant Professor Nimis, Captain, USAF, *Director of Undergraduate Studies*; Visiting Assistant Professor Belson, Captain, USAF

Eligibility Requirements. All freshmen and sophomores, men or women, are eligible to enroll in the General Military Course in the Air Force Reserve Officer Training Corps. For enrollment in the Professional Officer Course, the student must have completed successfully either the General Military Course or the six-week field training course; must execute a written agreement with the government to complete the Professional Officer Course; must be sworn into the enlisted reserve; and must agree to accept a commission in the U.S. Air Force Reserve upon graduation. In addition, each student must take at least one course in mathematical reasoning prior to graduation/commissioning. Students in the General Military Course and Professional Officer Course also will be required to attend one hour of leadership laboratory each week. All courses, except 2L, are open to all other students with consent of instructor.

General Military Courses

First Year

1. The Air Force Today. Development of aerospace power in the United States; mission, doctrine, and organization of the U.S. Air Force and its relationship to the other services within the Department of Defense. (May not be counted to satisfy graduation requirements.) Half course. *Nimis*

2L. Leadership Laboratory. Instruction in drill and ceremonies, wearing the uniform, giving commands, and other leadership activities. Mandatory for all Air Force ROTC cadets. Must be repeated each semester. Pass/fail grading only. No credit. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

Second Year

51. Development of Air Power. Growth and development of air power from dirigibles and balloons to the present, emphasizing evolution of concepts and doctrine governing air power employment in support of national objectives. (May not be counted to satisfy graduation requirements.) Half course. *Nimis*

Professional Officer Courses

All students selected to continue aerospace studies pursue the following courses:

Third Year

105S. Aerospace Leadership and Management. An introduction to management fundamentals to include the knowledge base and process of managing. One course. *Belson*

106S. Aerospace Leadership and Management. Application of management fundamentals to duties as junior officers/executives to include principles of leadership. One course. *Belson*

Fourth Year

205S. National Security Forces in Contemporary American Society. The role of the professional military officer in a democratic society and the environment in which national security policy is formulated. One course. *Staff*

206S. National Security Forces in Contemporary American Society. The evolution of U.S. nuclear strategy, the international context in which national security policy is implemented, and the military justice system. One course. *Staff*

African and Afro-American Studies Program (AAS)

A major or a certificate is available in this program.

The program in African and Afro-American Studies provides students with an interdisciplinary approach to the field, within which they may focus on Africa, North America, or the Caribbean. The courses are essential components of a liberal arts education. Students may complete a major or a certificate in the program. Nine courses (including a two-semester prerequisite course entitled Introduction to African and Afro-American Experiences) are required for the major; five are required for the certificate. A Duke summer study program is available in Zimbabwe/Botswana sponsored by the Department of Political Science.

The African and Afro-American Studies courses are listed below. (Full descriptions of cross-listed courses may be found in the Bulletin course listings of the particular department or program cited in the cross-listing, for example, Music 74.) In addition, Swahili and Arabic language courses are taught in the Asian and African Languages and Literature Program, and other relevant language courses in the Department of Romance Studies. A half-credit course in African dance technique is offered in the Dance Program.

Further information is available in 04 Allen Building.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

51, 52. Introduction to African and Afro-American Experiences. (CZ) An interdisciplinary study of black civilizations and cultures in Africa and the Americas from ancient to contemporary times. An overview of cultural studies methodologies. A survey of African and Afro-American life, thought, and expression in evolving societal contexts of slavery and racism; emancipation and segregation; desegregation and integration. One course each. *Staff*

74. Introduction to Jazz. (AL) See C-L: Music 74. One course. *Jeffrey*

100. Duke Summer Program: Zimbabwe/Botswana. (SS) See C-L: Political Science 100C; also C-L: Comparative Area Studies. Variable credit.

103. North African Culture. (AL) See C-L: Arabic 100; also C-L: Comparative Area Studies. One course. *Cooke or Cornell*

115. History of Africa. (CZ) See C-L: History 115; also C-L: Comparative Area Studies and Women's Studies. One course. *Ewald*

116. Race and Ethnic Relations. (SS) See C-L: Sociology 116. One course. *Staff*

119. Martin Luther King, Jr. and the Problem of Peace. (SS) See C-L: Political Science 119. One course. *Roberts*

122. Modern Africa. (CZ) See C-L: Cultural Anthropology 122; also C-L: Comparative Area Studies. One course. *O'Barr*

124S. Slave Society in Colonial Anglo-America: The West Indies, South Carolina, and Virginia. (CZ) See C-L: History 124S; also C-L: Comparative Area Studies. One course. *Gaspar*

127. The Caribbean in the Eighteenth Century. (CZ) See C-L: History 127. One course. *Gaspar*

131S. Comparative Government and Politics: Africa. (SS) See C-L: Political Science 161S; also C-L: Comparative Area Studies. One course. *Bates or Johns*

133. History of African-American Dance. (AL) See C-L: Dance 133. One course. *Staff*

138. Francophone Literature. (AL, FL) Prerequisite: good knowledge of French. See C-L: French 168; also C-L: Asian and African Languages and Literature 168 and Comparative Area Studies. One course. *Mudimbe-Boyi*

140S. Ascendancy of the Jazz Solo. (AL) Prerequisites: ability to read music, and Music 74 or consent of instructor. See C-L: Music 140S. One course. *Brothers*

145A, 145B. Afro-American History. (CZ) See C-L: History 145A, 145B. One course each. *Gavins*

152. Cult, Sect, and Church in Black Religion in America. (CZ) See C-L: Religion 154. One course. *Lincoln*

153. From the African Kraal to the African-American Church. (CZ) See C-L: Religion 153. One course. *Lincoln*

154. Art and Philosophy from West Africa to the Black Americas. (AL) See C-L: Art 174; also C-L: Comparative Area Studies and Literature 125. One course. *Powell*

156. The Blues Aesthetic: Afro-American Art in the Twentieth Century. (AL) See C-L: Art 176; also C-L: Literature 127. One course. *Powell*

157. Art, Architecture, and Masquerade in Africa. (AL) See C-L: Art 173; also C-L: Comparative Area Studies. One course. *Powell*

161S. Economics of Slavery in the American South. (SS) Prerequisite: Economics 149. See C-L: Economics 161S; also C-L: History 140S. One course. *Coats*

164. History and Religions of North Africa. (CZ) See C-L: Religion 164; also C-L: Comparative Area Studies, History 187, and Interdisciplinary Course 164. One course. *Cornell or Lawrence*

168S. The Atlantic Slave Trade. (CZ) See C-L: History 168S; also C-L: Comparative Area Studies. One course. *Gaspar*

169S. Afro-American Drama. (AL) Also taught as English 169S. One course. *Hill*

170. Brazilian Race Relations in Comparative Perspective. (CZ) See C-L: History 170C. One course. *French*

171. Politics of South African Apartheid (B). (SS) See C-L: Political Science 171; also C-L: Comparative Area Studies. One course. *Johns*

173, 174. Afro-American Literature. (AL) See C-L: English 167, 168. One course each. *K. Williams*

175S. The Southern Plantation as Historical Laboratory: Odyssey in Black and White, 1770-1970. (CZ) See C-L: History 175S. One course. *Nathans*

176S. The Southern Plantation as Historical Laboratory: Research Seminar. (CZ) See C-L: History 176S. One course. *Nathans*

179. History of South Africa, 1600-1960. (CZ) See C-L: History 179; also C-L: Comparative Area Studies. One course. *Ewald*

180. Writings in the Rural Tradition: From the Caribbean to the American South. (AL) See C-L: Literature 180; also C-L: Comparative Area Studies and English 180. One course. *Willis*

195S. Fugitive Slave (Maroon) Communities in New World Slave Societies. (CZ) Also taught as History 195S.40. C-L: Comparative Area Studies. One course. *Gaspar*

196S. Issues in the History of Tropical Africa. (SS) Also taught as History 195S.23. C-L: Comparative Area Studies. One course. *Ewald*

197S. The Destruction and Aftermath of Slavery in the Americas: A Comparative Perspective. (CZ) Also taught as History 195S.18. One course. *J. Scott*

198S. Senior Seminar. Open to seniors majoring in African and Afro-American Studies and to others with consent of instructor. One course. *Staff*

199S. Special Topics. Topics vary from semester to semester. One course. *Staff*

206. Origins of Afro-America. (CZ) See C-L: History 206. One course. *J. Scott*

233S. Slave Resistance and Social Control in New World Societies. (CZ) See C-L: History 233S; also C-L: Comparative Area Studies. One course. *Gaspar*

261. Islam in the African-American Experience. (CZ) See C-L: Religion 261. One course. *Lincoln*

264S. Poverty and Social Policy: Life Course Human Resource Development. (SS) Also taught as Public Policy Studies 264S.46. One course. *Staff*

270S. Topics in African Art. (AL) Consent of instructor required. See C-L: Art 270S. One course. *Powell*

299. Special Topics. Topics vary from semester to semester. One course. *Staff*

299S. Special Topics. Seminar version of African and Afro-American Studies 299. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

128. Writings in the Pan-African Tradition. (AL)

155. Comparative Perspectives on Literature and Social Change: From Plantation to City. (AL)

THE MAJOR

Students may choose one of the two following options.

A. North American Focus

Prerequisites: Two courses—African and Afro-American Studies 51, 52.

Major Requirements:

1. Three courses—One focusing upon North America in *each* of the following areas:
 - a. Arts or Literature
 - b. History
 - c. Social, Religious, Economic, or Political Institutions/Processes.
2. African and Afro-American Studies 198S (Senior Seminar).
3. Three additional courses, preferably in, but not limited to, one of the areas noted in Item 1. One of these three courses must focus upon Africa or on the Caribbean/Latin America.

B. African/Caribbean Focus

Prerequisites: Two courses—African and Afro-American Studies 51, 52.

Corequisites: Four (4) semester courses, or equivalent competency, in a single foreign language appropriate to the primary focus (African or Caribbean): Arabic, French, Spanish, Portuguese, or Swahili.

Major Requirements:

1. Three courses—One focusing upon Africa or the Caribbean/Latin America in *each* of the following areas:
 - a. Arts or Literature
 - b. History
 - c. Social, Religious, Economic, or Political Institutions/Processes.
2. African and Afro-American Studies 198S (Senior Seminar).
3. Three additional courses, preferably in, but not limited to, one of the areas noted in Item 1. At least one of these three courses must focus upon Africa and at least one must focus upon Caribbean/Latin America.

THE CERTIFICATE

Students who are not majoring in African and Afro-American Studies may complete a certificate in the field by satisfactory completion of the following five courses:

1. African and Afro-American Studies 51, 52.
 2. Three additional courses in the program—one in each of the following areas:
 - a. Arts or Literature
 - b. History
 - c. Social, Religious, Economic, or Political Institutions/Processes.
- N.B. One of these three courses must focus upon Africa or the Caribbean/Latin America.

Animal Behavior

For courses in animal behavior, see Biology.

Anthropology

See the Department of Biological Anthropology and Anatomy and the Department of Cultural Anthropology for information about those majors.

Arabic

For courses in Arabic, see Asian and African Languages and Literature.

Art and Art History (ART)

Professor Bruzelius, *Chair*; Assistant Professor Stiles, *Director of Undergraduate Studies*; Associate Professors Pratt and Wharton; Assistant Professors Cernuschi, Powell, Rice, and Van Miegroet; Professors Emeriti Markman, Spencer, and Sunderland; Adjunct Professors Lee and Mezzatesta; Adjunct Assistant Professor Reents-Budet; Assistant Professors of the Practice Noland and Shatzman; Instructor Smith

Majors in art history and design are available in this department.

HISTORY OF ART

Art history is the study of works of art in the context of the broader social, political, and intellectual cultures of which they are a part. Studying art history develops the ability to evaluate and organize information, visual as well as verbal; it also enhances the faculties of creative imagination, precise observation, clear expression, and critical judgment. Students of art history acquire a sophisticated understanding of the theory and practice of artistic production and reception.

A major or second major in art history provides basic training for those interested in art-historical or art teaching, museum and gallery work, art publishing, and advertising; the major also furnishes an appropriate background for graduate training in architecture. Art history's emphasis upon careful observation, the ordering of diverse sorts of information, expository writing, and scholarly research makes it a good general preparation for any profession.

20. Basic Art History. Credit for advanced placement on the basis of the College Board examination in Art History. Does not count toward the major in art history or design. One course.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

50. Introduction to Spanish Art. (AL, FL) The history of art in Spain from prehistoric times to Picasso and other artists of the twentieth century. (Taught in Spanish in Spain.) One course. *Staff*

69, 70. Introduction to the History of Art. (AL) The history of western architecture, sculpture, and painting in a cultural context. 69: from prehistory to the Renaissance (c. 1400). 70: from the Renaissance to the present. One course each. *Staff*

100. Art and Architecture of Vienna. (AL) Famous periods of art and architecture particular to Vienna, with special emphasis on the Baroque. In-class slide presentations combined with field trips to the Vienna Museum of Art History, the Albertina, and architecturally noteworthy sites. Taught in English in the Duke in Vienna Program. One course. *Staff*

114. The Aegean Bronze Age. (CZ) See C-L: Classical Studies 155. One course. *Younger*

115. Ancient Greece. (CZ) Prerequisite: Classical Studies 11S, 53, 123, or 124, or History 53, or consent of instructor. See C-L: Classical Studies 147. One course. *Younger*

117. Pompeii. (CZ) See C-L: Classical Studies 162. One course. *Richardson*

120. The Art of Egypt and the Ancient Near East. (AL) Art and architecture of the major urban centers of Egypt, Syria-Palestine, Mesopotamia, and Iran from the fourth millennium B.C. to the conquest of Alexander. Emphasis on architecture, sculpture, and painting. One course. *Staff*

121. The Art of Ancient Italy. (AL) Art and architecture in Italy from the Villanovan period to the late Roman Republic. Emphasis on relations among the Etruscans, early Rome, and the Greek cities of the South. Not open to students who have had Classical Studies 126. C-L: Classical Studies 121. One course. *Staff*

122. Art and Myth in Ancient Greece. (AL) Art in relation to myth in Greek society from the Orientalizing to the Hellenistic period. Emphasis on architectural sculpture and painting; connections between monumental and small-scale arts. C-L: Classical Studies 122. One course. *Staff*

123. Greek Art and Archaeology I. (AL) See C-L: Classical Studies 123. One course. *Younger*

124. Greek Art and Archaeology II. (AL) See C-L: Classical Studies 124. One course. *Younger*

125. The City in Antiquity. (CZ) Urban architecture and city planning in the ancient Near East and the classical world. Forms and development of the urban environment as a function of religious, political, and economic factors from the beginnings of

Mesopotamia to the centers of Hellenistic Greece and the Roman Empire. C-L: Classical Studies 125. One course. *Staff*

126. Rome: History of the City. (CZ) See C-L: Classical Studies 145. One course. *Staff*

128. Art of the Roman Empire. (AL) Art and architecture in the Roman world from Augustus to Theodosius. Emphasis on portraiture, private arts, and triumphal monuments. Not open to students who have had Classical Studies 126. C-L: Classical Studies 128. One course. *Staff*

129. The History of Prints and Printmaking. (AL) The art of printmaking from the fifteenth through the eighteenth centuries. The impact of the invention of printing; technical and artistic innovations; the contributions of individual artists from Mantegna to Tiepolo. Firsthand experience of basic printmaking techniques in the studio; study of original works of art on frequent trips to local museums and libraries. Consent of instructor required. C-L: Medieval and Renaissance Studies. One course. *Rice*

130. Late Antique Christian Art. (AL) Art and architecture of the Christian community from the third to the fifth century in the context of the Roman imperial state. C-L: Classical Studies 130 and Religion 130. One course. *Wharton*

131. Art of the Early Middle Ages. (AL) Survey of Early Christian, Byzantine, Carolingian, and Ottonian art and architecture. Focus on the impact of church and empire on the form and function of artworks from the third to eleventh centuries. C-L: Classical Studies 131 and Medieval and Renaissance Studies. One course. *Bruzelius or Wharton*

132. Art of the Late Middle Ages. (AL) Romanesque and Gothic art and architecture from the eleventh through the fourteenth centuries. The artistic impact of monasticism, pilgrimage, the Crusades, and urbanization. The role of ecclesiastic, civic, and courtly patrons. C-L: Medieval and Renaissance Studies. One course. *Bruzelius or Wharton*

134. Medieval Architecture. (AL) The development of medieval architecture through the mid-fourteenth century. Emphasis on churches, with some discussion of castles and fortifications, town planning, and domestic architecture. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

135. Gothic Cathedrals. (AL) Major monuments of Gothic architecture in the twelfth and thirteenth centuries on the continent and in England with concentration on the great cathedrals of France. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

139. Aspects of Medieval Culture. (CZ) See C-L: Medieval and Renaissance Studies 114; also C-L: Classical Studies 139 and History 116. One course. *Bruzelius, Solterer, and Witt*

140. Giotto and the Origins of the Renaissance. (AL) Painting and sculpture in Italy, with emphasis on Pisano, Duccio, Giotto, and the crisis of the Black Death. C-L: Medieval and Renaissance Studies. One course. *Staff*

141. Fifteenth-Century Italian Art. (AL) Painting, sculpture, and architecture from Masaccio, Donatello, and Brunelleschi to Leonardo. Emphasis on the art of Florence. C-L: Medieval and Renaissance Studies. One course. *Rice*

142. Sixteenth-Century Italian Art. (AL) Painting and sculpture in Rome and Florence: Michelangelo, Raphael, Leonardo. The rise and diffusion of mannerism: Pontormo to Tintoretto. C-L: Medieval and Renaissance Studies. One course. *Rice*

145. Renaissance Art in Florence. (AL) Paintings, sculpture, and architecture from Giotto to Michelangelo based on the works of art preserved in Florence. Emphasis on

individual artists and their creations and on the relation of the artists to the society of their times. (Taught in Italy.) C-L: Medieval and Renaissance Studies. One course. *Rice*

146. Italian Renaissance Architecture. (AL) Development of building types and city planning in the fifteenth and sixteenth centuries in central and northern Italy. Emphasis on Brunelleschi, Alberti, Bramante, Michelangelo, and Palladio. C-L: Medieval and Renaissance Studies. One course. *Rice*

148. Art of the Netherlands in the Fifteenth Century. (AL) Early Netherlandish painting in the Burgundian Netherlands from Hubrecht and Jan Van Eyck to Gerard David and Hieronymus Bosch. Cultural, historical, and intellectual environment in Flanders and Brabant; civic and courtly patronage in Doornik (Tournai), Ghent, Bruges, Mechlin, and Antwerp; new research strategies of contemporary evidence. C-L: Medieval and Renaissance Studies. One course. *Van Miegroet*

149. Aspects of Renaissance Culture. (CZ) See C-L: Medieval and Renaissance Studies 115; also C-L: History 148. One course. *L. Patterson, Rasmussen, Van Miegroet, and Witt*

150. Italian Baroque Architecture. (AL) Architecture in Italy in the seventeenth and eighteenth centuries. Emphasis on the contributions of Bernini, Borromini, Cortona, Guarini, and Juvarra. The evolution of building types, both secular and religious; town planning; garden and landscape history. Special attention to the cultural, economic, and political forces that shaped the Baroque city. C-L: Medieval and Renaissance Studies. One course. *Rice*

151. Art of Italy in the Seventeenth Century. (AL) Caravaggio, the Carracci, Guido Reni, Domenichino, Bernini, and Poussin. Modes of description and narration; the concern with the status of pictorial representation; and the attempts to define and retrieve the canonical achievements of the early sixteenth century. One course. *Rice*

152. Art of the Netherlands in the Sixteenth Century. (AL) Painting in Antwerp and the Spanish Netherlands in a period of political turbulence (Reformation, Counter-Reformation); Pieter Bruegel, Frans Floris, Hendrick Goltzius; landscape painters and the exiles at Frankenthal; Flemish painters at the court of Rudolph II in Prague; art and politics in Flanders, Brabant, and Holland. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Van Miegroet*

153. Art of the Northern Netherlands in the Seventeenth Century. (AL) A contextual study of northern Netherlands art, seen through the major Dutch cities and towns where painters, such as Frans Hals and Johannes Vermeer, were at work. Rembrandt and his school; Dutch art in its historical, societal, moral, and psychological context. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Van Miegroet*

154. German Art in the Fifteenth and Sixteenth Centuries. (AL) An examination of German art, including Stefan Lochner, Konrad Witz, Albrecht Dürer, and Hans Holbein the Younger; the significance of the Councils of Konstanz and Basel; the revolutionary impact of the printing press. New trends in sculpture, including the relatively unknown wood carvings created in Nuremberg between 1475 and 1515. C-L: Comparative Area Studies, Interdisciplinary German Studies, and Medieval and Renaissance Studies. One course. *Van Miegroet*

155. Mercantile Culture and Art in the Netherlands. (CZ) The mercantile culture and its relationship with art and the occupation of artist in the Netherlands (fifteenth-seventeenth centuries, with main stress on seventeenth). The economy of towns, the artist's social position, the place of art in the local economy, and the connections between economic well being and the emergence of art as asset. Commercial evolution: institu-

tions (markets, bans, stock exchanges), instruments (for example, the bill of exchange), and attendant conditions (risk, speculations, panics). The peculiarities of Dutch picturing, the role of art as moveable product, liquidity and store of value. Prerequisites: Art 70 and consent of instructor. C-L: Comparative Area Studies and Economics 152. One course. *de Marchi and Van Miegroet*

156. Art of the Southern Netherlands in the Seventeenth Century. (AL) The artistic preeminence of Antwerp in the southern Netherlands from Jan I Bruegel to Pieter Paul Rubens, Antoon Van Dyck, and Jacob Jordaens. New cultural, political, and artistic attitudes under the Spanish/ Austrian Habsburgs; atelier practices and connoisseurship problems; prints and drawings; creative methods of research. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Van Miegroet*

158-159. Art and Cultural History of Flanders and the Netherlands from the Fifteenth through the Seventeenth Centuries. (AL) A contextual interpretation of art and culture of the Greater Netherlands through intensive and immediate contact with the cultural legacy of major cities such as Ghent, Bruges, Leuven, Antwerp, and Brussels in the south, and Haarlem, Leiden, Amsterdam, Delft, and Utrecht in the north. Visits to major museums, cathedrals, the atelier of Rubens; discussion of major painters such as Van Eyck, Bosch, Bruegel, Rembrandt, Hals, Vermeer, Jordaens, and Rubens. (Taught in Flanders and the Netherlands.) C-L: Comparative Area Studies. Two courses. *Van Miegroet*

161. Nineteenth-Century Art, 1789-1848: Revolution to Revolution. (AL) Painting and sculpture of leading artists within the movements of neoclassicism, romanticism, and mid-century realism. C-L: Comparative Area Studies. One course. *Cernuschi*

162. American Art from Colonial Times to 1900. (AL) The development of an American national school in portraiture, history painting, landscape, genre scenes, and still-life. Major figures include Copley, Bingham, Cole, Church, Whistler, and Eakins. One course. *Powell*

163. Twentieth-Century American Art. (AL) Survey of American twentieth-century art from 1900 to the present, including major stylistic and theoretical developments and movements as well as the art of women, and Afro-American, Asian-American, and native American artists. C-L: Literature 163. One course. *Powell or Stiles*

166. Nineteenth-Century Art after 1848: The Avant-garde and Modernism. (AL) A survey of the second half of the nineteenth century in Europe with particular emphasis on realism, impressionism, post-impressionism, and symbolism. One course. *Cernuschi or Stiles*

167. Twentieth-Century Art, 1900-1945. (AL) Major artistic movements and theoretical aims of early modernism: fauvism, cubism, expressionism, futurism, constructivism, suprematism, dada, surrealism, deStijl, Bauhaus, and Neue Sachlichkeit. C-L: Comparative Area Studies and Literature 167. One course. *Cernuschi or Stiles*

168. Art since 1945. (AL) Major artistic movements and theory in Europe and the United States after World War II: abstract expressionism, color field, pop art, minimal art, Arte Povera, process, conceptual, and performance art, earthworks, photo-realism, neo-expressionism, and appropriation. C-L: Comparative Area Studies and Literature 168. One course. *Cernuschi or Stiles*

169. Modern Sculpture. (AL) The development of sculpture from Rodin to the present. Special attention to the transformation of sculpture in the twentieth century by new materials, methods, and environments. Emphasis on both abstract and figurative works. One course. *Cernuschi or Stiles*

172. Topics in Oriental Art. (AL) A critical survey of Chinese, Korean, and Japanese art from the earliest times to the nineteenth century. C-L: Comparative Area Studies. One course. *Lee*

173. Art, Architecture, and Masquerade in Africa. (AL) Major art forms, monuments, vernacular structures, and masking traditions in West, Central, and Southern Africa. From ancient times to the present. C-L: African and Afro-American Studies 157 and Comparative Area Studies. One course. *Powell*

174. Art and Philosophy from West Africa to the Black Americas. (AL) A survey of several major cultural groups in West Africa and their impact on the arts and religions of blacks in South America, the Caribbean, and the United States. C-L: African and Afro-American Studies 154, Comparative Area Studies, and Literature 125. One course. *Powell*

175. Art and Material Culture of the Southern United States. (AL) A survey of art that was created in the southern United States and made by artists from the South. Special attention given to material culture, vernacular art forms, site-specific creations, and work that addresses the idea of a regional identity. C-L: Literature 126. One course. *Powell*

176. The Blues Aesthetic: Afro-American Art in the Twentieth Century. (AL) Art of the twentieth century, with an emphasis on works derived from an Afro-United States cultural perspective. Major figures include Aaron Douglas, Jacob Lawrence, Charles White, Elizabeth Catlett, and Romare Bearden. C-L: African and Afro-American Studies 156 and Literature 127. One course. *Powell*

177. The History of Conceptual Art. (AL) Works in the visual arts in which the primary means and medium of expression is language and systems: symbolic, natural, social, cultural, and political structures and institutions. Theoretical discussion focusing on the dematerialized art object and on the materialized art idea. C-L: Comparative Area Studies and Literature 171. One course. *Stiles*

178. Pre-Columbian Art and Architecture. (AL) A survey of the art and architecture of American cultures in Mexico, Central America, and Peru before the Spanish conquest. Particular emphasis on their political and religious functions, including the Olmec, Teotihuacan, Maya, Aztec, and Inca civilizations. C-L: Comparative Area Studies. One course. *Reents-Budet*

179. The History of Performance Art. (AL) Works in the visual arts in which the primary means and medium of expression is the human body in happenings, Fluxus, demonstrations, destruction art, body art, and performance since 1955. Theoretical discussion focusing on the challenge that live art poses to the traditional paradigm of the art object. C-L: Comparative Area Studies and Literature 176. One course. *Stiles*

180. The Interpretation of Abstraction. (AL) Different manifestations and philosophies of abstract art from their early philosophical roots in the late nineteenth century (Pater, Schopenhauer, Nietzsche) to twentieth-century formulations of modernism (Shapiro, Greenberg). Emphasis on the work of Picasso, Kandinsky, Malevich, Mondrian, Pollock, Rothko, Newman, Stella, Reinhardt, and Morris. One course. *Cernuschi*

181. The New York School: Art of the 1940s and 1950s. (AL) American art after World War II: abstract expressionism and the New York School. Emphasis on gestural painting (Pollock, de Kooning, Kline) and color field (Rothko, Newman, Gottlieb) with particular attention to issues of criticism and interpretation. One course. *Cernuschi*

182. The Concept of Expressionism. (AL) Expressionism in modern art with emphasis on early twentieth-century examples in Scandinavia, Austria, and Germany, abstract expressionism in New York, and recent manifestations of neo-expressionism

associated with the postmodern. Emphasis on Munch, Schiele, Kirchner, Nolde, Pollock, de Kooning, Schnabel, Rainer, Baselitz, and Kiefer. One course. *Cernuschi*

184. History of Impressionism. (AL) The evolution of the impressionist movement and post-impressionist reactions of the 1880s. Particular attention to the work of Manet, Degas, Monet, Renoir, and Pissarro. C-L: Comparative Area Studies. One course. *Cernuschi*

185. Post-Impressionism. (AL) The emergence and development of post-impressionist styles—neo-impressionism, synthetism, symbolism—with emphasis on Seurat, Cézanne, Van Gogh, and Gauguin. The impact of post-impressionism on early twentieth-century movements, including fauvism, expressionism, and cubism. One course. *Staff*

186. Feminism in Twentieth-Century Art. (AL) A study of the contributions of women artists to the formal and theoretical discourses of modern art with particular attention to issues of feminism. C-L: Literature 149 and Women's Studies. One course. *Stiles*

187. Surrealism. (AL) The origins, aims, literature, and politics of the international movement of surrealism, which flourished between the world wars, examined in the context of surrealist theory. The psychoanalytic and metaphysical sources of surrealist poetry and visual representations as reflecting a utopian ideology of liberation. C-L: Comparative Area Studies. One course. *Stiles*

188. Twentieth-Century Modernist and Postmodernist Criticism. (AL) A survey of the writings of artists, critics, and art historians from the late nineteenth century to the present, concentrating on major critical debates and on the interplay of various methodologies including formalist, iconographic, Marxist, feminist, psychoanalytic, structuralist, and poststructuralist in the interpretation of twentieth-century art. C-L: Literature 188. One course. *Cernuschi or Stiles*

189. Modern Architecture. (AL) The history of architecture from nineteenth-century Beaux-Arts classicism through Art Nouveau and the modern movement to postmodernism. Political and ideological as well as the formal and technical aspects of building investigated through primary texts. C-L: Literature 189. One course. *Wharton*

191, 192. Independent Study. Directed reading and research. Open only to qualified students in the junior year, by consent of Director of Undergraduate Studies. One course each. *Staff*

193. Art and Culture of Mesoamerica. (AL) The art of pre-Columbian Mesoamerica (Mexico, Guatemala, Belize, and Honduras) from the beginnings of permanent settlements through the coming of the Spaniards (2000 B.C.-1519 A.D.). The Olmec, Teotihuacan, Zapotec, Maya, Mixtec, and Aztec cultures, including the numerous indigenous writing systems, studied in order to understand sociopolitical and religious institutions. C-L: Comparative Area Studies. One course. *Reents-Budet*

194. Maya Art and Culture. (AL) The ancient Maya civilization of Mexico, Guatemala, and Belize explored through study of their material culture. Mayan religious and political iconography in conjunction with Mayan hieroglyphic writing. Approaches include those of archaeology, ethnohistory, and linguistics. C-L: Comparative Area Studies. One course. *Reents-Budet*

195. Pre-Columbian Art and Culture of Andean South America. (AL) The art of Peru, Bolivia, Ecuador, and Colombia from the beginnings of permanent settlements through the coming of the Spaniards (1534 A.D.), concentrating on sociopolitical and religious institutions. C-L: Comparative Area Studies. One course. *Reents-Budet*

For Seniors and Graduates

201S. Topics in Greek Art. (AL) Specific aspects of the art or architecture in the Greek world from the late Geometric to the Hellenistic periods. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 220S. One course. *Staff*

202S. Topics in Roman Art. (AL) Selected topics in the art and architecture of late republican and imperial Rome. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 227S. One course. *Staff*

205S. Greek Architecture. (AL) See C-L: Classical Studies 233S. One course. *Richardson or Younger*

216. The Art of the Counter Reformation. (AL) Religious art in Gothic Europe during and following the Council of Trent. Issues such as the rise of the new religious orders; the revival of interest in the early Church and the origins of Christian archaeology; the Church's use of art in its war against Protestantism. The validity of the concept of a counter reformation style. C-L: Medieval and Renaissance Studies. One course. *Rice*

227S. Roman Painting. (AL) See C-L: Classical Studies 236S. One course. *Richardson*

233S. Topics in Early Christian and Byzantine Art. (AL) Specific conceptual, institutional, or formal problems in the art of the late antique world or of the east Roman Empire. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 230S, Medieval and Renaissance Studies, and Religion 275S. One course. *Wharton*

236S. Topics in Romanesque and Gothic Art and Architecture. (AL) Analysis of an individual topic. Subject varies from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. One course. *Bruzelius*

237S. Greek Painting. (AL) See C-L: Classical Studies 232S. One course. *Stanley*

238S. Greek Sculpture. (AL) See C-L: Classical Studies 231S. One course. *Younger*

243S. Topics in Netherlandish and German Art. (AL) Specific problems in northern Renaissance or baroque art such as the Antwerp workshops of the sixteenth century or a critical introduction to major artists such as Van Eyck, Bosch, Dürer, and Rubens. An analytical approach to their lives, methods, atelier procedures and followers; drawings and connoisseurship problems; cultural, literary, social, and economic context; documentary and scientific research strategies. Subject varies from year to year. Consent of instructor required. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Van Miegroet*

244S. International Expressionism. (AL) A synchronic view of the expressionist revolution in modern aesthetic conceptions throughout Europe in the period 1905-1925, emphasizing fusions of established aesthetic modes with new technological media, and the opening up of the Western tradition to other cultures, especially African. German expressionism forms the nucleus of the course and its study is integrated with the theory and practice of Italian futurism, Anglo-American imagism and vorticism, French surrealism, and Russian rayonnism. C-L: German 244S. One course. *Cernuschi and Rolleston*

247S. Topics in Italian Renaissance Art. (AL) Specific problems dealing with iconography, style, or an individual master from c. 1300 to 1600. Subject varies from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. One course. *Rice*

257S. Topics in Pre-Columbian Art and Culture. (AL) Selected topics in pre-Columbian art and archaeology with an emphasis on the political and cultural context of the artifact. Subject varies from year to year. Consent of instructor required. C-L: Comparative Area Studies. One course. *Reents-Budet*

260S. Topics in Italian Baroque Art. (AL) Problems in Italian art and architecture from c. 1580 to c. 1750. Topics vary from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. One course. *Rice*

265S. Topics in Nineteenth-Century Art. (AL) Focus on a major artist, movement, or trend in nineteenth-century art. Subject varies from year to year. Consent of instructor required. One course. *Cernuschi or Stiles*

270S. Topics in African Art. (AL) Specific problems of iconography, style, or a particular art tradition. Subject varies from year to year. Consent of instructor required. C-L: African and Afro-American Studies 270S. One course. *Powell*

271S. Topics in Art of the United States. (AL) Selected topics from colonial times to 1945, with emphasis on major cultural issues, movements, works, and/or artists. Consent of instructor required. One course. *Powell or Stiles*

283S. Topics in Modern Art. (AL) Selected themes in modern art before 1945, with emphasis on major movements or masters. Subject varies from year to year. Consent of instructor required. C-L: Comparative Area Studies. One course. *Cernuschi or Stiles*

291, 292. Independent Study/Special Problems in Art History. Directed reading and research. Consent of instructor required. One course each. *Staff*

296S. Methodology of Art History. (AL) Approaches to the study and theory of art: historiography, connoisseurship, iconology, and criticism. Consent of instructor required. One course. *Staff*

297S. Topics in Art since 1945. (AL) Historical and critical principles applied to present-day artists and/or movements in all media since World War II. Consent of instructor required. C-L: Comparative Area Studies. One course. *Cernuschi or Stiles*

298S. Topics in Modern and Postmodern Architecture. (AL) The study of particular architects, movements, or building genres in their conceptual and political contexts. Subject varies from year to year. Consent of instructor required. C-L: Comparative Area Studies. One course. *Wharton*

299S. Critical Theory. (AL) Understanding of the visual arts in terms of the theoretical developments in other disciplines (for example, literature, women's studies, Marxism, and anthropology). Focus on the writings of theory-centered art historians and critics. Consent of instructor required. One course. *Cernuschi, Stiles, or Wharton*

DESIGN

Studio art courses offer directed experiences in the practice of the visual arts, enhancing the understanding of art both within the history of culture and as an individual human achievement. Department offerings emphasize the analysis and articulation of visual concepts and processes as they relate to a broader education in the humanities and sciences.

A major or concentration in studio art can provide the foundation for further study in various areas of the visual arts. It may prepare the student for further training as an artist, teacher, or architect, as well as in related fields such as advertising or design. Lower-level courses emphasize the fundamentals of drawing, color, and form; upper-level courses encourage the student to develop a more individual conceptual approach and style, within the context of historical precedents and traditions.

21. General Art, Studio. (AL) Credit for advanced placement on the basis of the College Board examination in Studio Art. Does not count toward the major in design. One course.

53. Drawing. (AL) Directed approaches to practice in life drawing and in the expression of graphic concepts. Consent of instructor required. One course. *Staff*

54. Two-Dimensional Design and Color. (AL) Experiments in form and color, with work from observation. Introduction to color theory in various media. Prerequisite: Art 53. One course. *Pratt or Smith*

56. Sculpture. (AL) Introduction to the principles and processes of sculpture. Consent of instructor required. One course. *Noland*

101. Book Illustration. Each student will design and illustrate a story, journal, or grouping of poems. Projects will develop from initial sketches, to maquettes, and finally to the form of a bound book. Prerequisites: Art 53 and consent of instructor. One course. *Shatzman*

102. Figure Drawing. (AL) The human figure through different artistic media and visual concepts. Prerequisites: Art 53 and 54, and consent of the instructor based on portfolio. One course. *Staff*

103, 104. Painting. (AL) Studio practice in painting with individual and group criticism and discussion of important historic or contemporary ideas. Prerequisites: Art 54 or equivalent and consent of instructor. One course each. *Pratt*

105, 106. Advanced Drawing and Color. (AL) Work from life or in formal modes, with emphasis on personal development, through individual and group criticism and discussion. Prerequisites: Art 53 and 54 and consent of instructor. One course each. *Pratt*

107. Printmaking: Silkscreen. (AL) Studio course on the silkscreen medium and its stencil-making process including paper, film, blockouts, crayon, and photographic methods. Prerequisites: Art 53, 54 and consent of instructor. One course. *Shatzman*

108. Printmaking: Lithography. (AL) Introductory course on stone lithography and its drawing and printing techniques. Includes both black and white and color printing. Prerequisites: Art 53, 54 and consent of instructor. One course. *Shatzman*

109. Printmaking: Relief and Monotype. (AL) Studio course focusing on the relief methods of woodcut and linoleum block printing and monotype techniques. Concentration on the technical and historical aspects of the media at hand as well as visual and conceptual concerns. Prerequisites: Art 53, 54 and consent of instructor. One course. *Shatzman*

110. Intermediate Sculpture. (AL) Studio practice in sculpture at the intermediate level. Group and individual discussion and critique. Prerequisite: Art 56 or consent of instructor. One course. *Noland*

111. Advanced Sculpture. (AL) Studio practice in sculpture at the advanced level. Group and individual discussion and critique. Prerequisites: Art 56 and 110, or consent of instructor. One course. *Noland*

112. Ceramics. (AL) See C-L: Institute of the Arts 112. One course. *Staff*

113. Printmaking: Intaglio. (AL) Studio course on directed problems in the intaglio medium including etching, aquatint, drypoint, black and white and color printing methods. Prerequisites: Art 53, 54 and consent of instructor. One course. *Shatzman*

118S. American Communities: A Photographic Approach. (SS) Consent of instructor required. See C-L: Public Policy Studies 176S; also C-L: Film and Video. One course. *Harris*

119S. Advanced Documentary Photography. (SS) Prerequisite: Art 118S, Public Policy Studies 176S, or consent of instructor. See C-L: Public Policy Studies 177S. One course. *Harris*

165. Photography. (AL) The history of photography from its origins in the mid-nineteenth century, through the innovations in the 1930s that brought into use smaller, faster, and more discrete cameras, to the instant and ubiquitous presence it currently enjoys. Theoretical and historical readings complemented by the taking and processing of photographs. An exhibition of class work to be held at the end of the semester. Prerequisite: access to camera. C-L: Film and Video. One course. *Noland*

180S. Theory of Design. (AL) Visual thinking and innovations in historical and contemporary art. Formal analysis and discussion of important issues for students involved in creating art. Prerequisites: two courses in design and consent of instructor. One course. *Pratt*

203, 204. Advanced Painting. (AL) Prerequisites: Art 103, 104 and consent of instructor. One course each. *Pratt*

207, 208. Advanced Projects in Printmaking. (AL) Opportunity to work in the area(s) of choice. Emphasis on the visual and conceptual development through experimentation and practice in printmaking. Prerequisites: Art 53, 54, 107, 108, and consent of instructor. One course each. *Shatzman*

217, 218. Individual Project. (AL) Independent work open to highly qualified juniors and seniors on recommendation of instructor and invitation of department. One course each. *Staff*

See also Institute of the Arts in this bulletin.

COURSES CURRENTLY UNSCHEDULED

116S. Athens. (CZ)

137-138. Roman and Non-Roman in Ancient Italy. (CZ)

143. Classical Tradition in the Renaissance. (CZ)

144. Central Italian Art. (AL)

160. Rococo to Neoclassicism: Eighteenth-Century European Art. (AL)

206S. Roman Architecture. (AL)

264S. Topics in Romanticism. (AL)

THE MAJOR

The student will elect a sequence of courses emphasizing either the history of art or design. The department offers work leading to graduation with distinction. See the section on honors in this bulletin.

History of Art

Major Requirements. The major in art history requires at least eight courses. Both Art 69 and 70 are required. The other six courses should be distributed across the fields of ancient, medieval, Renaissance/baroque, modern, and non-Western (pre-Columbian, African, Oriental). Students must, in any case, take at least one course in four of these

five areas. No fewer than one of these eight courses must also be a 200-level seminar. Two years of college-level study or the equivalent in French, German, or Italian are strongly recommended. Majors contemplating graduate work in history of art are advised to take more than eight courses in history of art and to gain competence in French and German. It is suggested that students who are interested in preparing for graduate work in architecture supplement their major requirements in the history of art and architecture with the following courses: Mathematics 31, 32 and either Mathematics 103 or Physics 51L, 52L; Art 53 and either Art 54 or 56; Institute of the Arts/Biology 45S; Engineering 75L or 83L.

Design

Corequisites. Art 69 or 70 and one other art history course.

Major Requirements. Art 53, 54, and five additional upper-level courses, one of which must be in each of three primary areas: painting, printmaking, and sculpture. Design majors are strongly encouraged to take an independent study and to arrange a solo or group campus exhibition of the resulting work during their senior year.

DOUBLE MAJOR IN ART HISTORY AND DESIGN

Major Requirements. Students who wish to have a double major in art history and design must take a total of thirteen courses in the department, as follows. In art history, the student must take Art 69 or 70, and five courses at the 100-level or above, including at least one 200-level seminar. These five courses must be distributed over four of the following five areas: Ancient, Medieval, Renaissance/Baroque, Modern, and Non-Western. In design, the student must take Art 53 and 54 or 56 as well as at least five courses at the 100-level.

Institute of the Arts (AI)

A certificate, but not a major, is available in this program.

The Institute of the Arts administers an undergraduate certificate program in the arts, provides advisors for interdepartmental concentrations in the arts and assists students in designing individualized courses of study, offers interdisciplinary courses, sponsors artist residencies, coordinates and promotes activities in the creative and performing arts, and works to expand the role of the artist in a liberal arts setting. Courses, festivals, and events sponsored by the institute bring together faculty and students in different art forms to encourage an interdisciplinary perspective. A fall-semester off-campus residency program, the Duke in New York Arts Program, provides academic and professional experiences for selected juniors and seniors. For further information about the institute, inquire in 109 Bivins Building.

DUKE IN NEW YORK ARTS PROGRAM

The institute-sponsored Duke in New York Arts Program offers an intensive, off-campus experience for a select group of juniors and seniors. The program has four components, each earning one credit: two seminars, an arts internship, and a course at New York University. The Duke courses are described below under institute courses. For information on admission to this program, contact the Institute of the Arts.

INSTITUTE OF THE ARTS (AI)

20S. Structure. Does not count toward the areas of knowledge requirements. See C-L: Biology 45S. One course. *Wainwright*

101S. Arts Resources in New York. (AL) Investigation of a central theme through attendance at selected art events in the New York area supplemented by discussions, critical papers, and reports. Visiting Duke faculty members and New York practitioners

in the arts provide guest lectures and lead discussions. Open only to those admitted to the Duke in New York Arts Program. One course. *Staff*

102. Arts Internship in New York. Immersion in the professional art world through apprenticeship to a sponsoring artist, scholar, or organization chosen to match each student's area of interest and expertise. Offered only on the pass/fail basis and open only to students admitted to the Duke in New York Arts Program. One course. *Staff*

103S. Arts Production, Promotion, and Presentation in New York. Analysis and investigation of the processes by which representative arts events and endeavors in New York are conceived, developed, produced, promoted, performed, and evaluated. Guest lectures by practitioners in these processes. Open only to students admitted to the Duke in New York Arts Program. One course. *Staff*

112. Ceramics. (AL) Studio practice in the fundamentals of ceramics. Incorporates handbuilding techniques and sculpture in clay with emphasis on figurative and architectural forms. Wheel and throwing techniques. Group and individual criticism. Experimentation with range of surfaces and glazes. Study of both historical and contemporary ceramics. Consent of instructor required. C-L: Art 112. One course. *Staff*

115S. Film and Video Theory and Practice. (AL) Prerequisite: Drama 65, English 81, or Literature 177. See C-L: English 183S; also C-L: Drama 131S and Film and Video. One course. *Staff*

121S. The Diaghilev Ballet, 1909-1929. (AL) Prerequisite: junior or senior standing or consent of instructor. See C-L: Dance 188S; also C-L: Interdisciplinary Course 188S. One course. *Dickinson and staff*

122. The Arts in Contemporary Culture. (AL) The arts as a form of cultural practice, locating them in their sociopolitical context. The relationship between aesthetic history and cultural history. Questions about spectatorship, gender, race, and social class as they relate to the production, performance, perception, and criticism of the arts. Attendance at performances, exhibitions, and presentations. One course. *Desmond*

130. Inter-Arts: Theory and Practice. (AL) Principles and techniques in contemporary interdisciplinary performance, using several art forms. Focus on interrelationships of art forms and collaborative process. Assignments in creation of original works. One course or one-half course. C-L: Dance 130 and Drama 110. Variable credit. *Staff*

150. Managing the Arts. Various aspects of planning, organization, promotion, resource development, and general operations of such typical arts organizations as arts councils, museums and galleries, subscription series, orchestras, and dance and theatre companies. Private, public, and governmental support for the arts. Not open to freshmen. One course. *Silbiger*

151S. Art and Its Making. (AL) An inquiry into artistic process from a conceptual survey of dominant views to direct interviewing of and discussion with artists. Not open to freshmen. One course. *Staff*

180, 181. Special Topics. (AL) Subjects associated with visiting Artists-in-Residence in the institute. Discussions and lectures conducted by guest artists on aspects of their work, views of the arts, associations with other disciplines. Previous topics have included "George Balanchine and Contemporary Ballet" and "Aspects of Broadway Bound." Topics announced each semester. Half course, one course, respectively. Variable credit. *Staff*

191, 192. Independent Study. Directed reading and research. Consent of instructor required. One course each. *Staff*

COURSES CURRENTLY UNSCHEDULED

110S. Video and Performance. (AL)

123. Music Theater Practicum

ARTIST-IN-RESIDENCE PROGRAM

The Nancy Hanks Artist Residency Program brings distinguished artists to Duke to interact with students, faculty, and the community at large, in settings as diverse as formal courses, class visits, performances and exhibitions, informal workshops and seminars, and off-campus programs. Courses by Nancy Hanks Resident Artists and by other visiting artists in the institute may not be listed in the bulletin since they vary from year to year. Consult the current course schedule and the institute for information about courses by artists in residence.

Asian and African Languages and Literature (AAL)

Professor Cooke, *Director*; Assistant Professor Nagai, *Director of Undergraduate Studies*; Associate Professor Wang; Assistant Professor Zhang; Professor of the Practice Yao; Lecturers Cornell and Khanna; Instructor Endo. Affiliated faculty: Professors Lawrence (religion) and O'Barr (cultural anthropology)

A certificate, but not a major, is available in this program.

Asian and African Languages and Literature provides instruction in several languages, literatures, and linguistics of Asia and Africa. Languages offered are Arabic, Chinese, Hebrew, Hindi, Japanese, Korean, Persian, and Swahili. The program offers Arabic, Chinese, Hebrew, Hindi, Japanese, and Korean literature and linguistics courses, many in translation. Its courses are particularly compatible with a major in Comparative Area Studies and the Literature Program.

To earn the certificate in Asian and African Languages and Literature students must take two years of introductory and intermediate language instruction and five other courses, consisting of the core course, Asian and African Languages and Literature 121 (Introduction to Asian and African Literature) or Asian and African Languages and Literature 131 (Introduction to Asian and African Linguistics); two language courses at the third-year level (125, 126); a 100-level related literature or culture course; and one course in a related Asian or African language, literature, or linguistics. During the spring semester an Asian and African film festival is held.

ASIAN AND AFRICAN LANGUAGES AND LITERATURE (AAL)

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

121. Introduction to Asian and African Literature. (AL) An exploration of the ways in which different societies in Asia and Africa encourage particular constructions of self, sexuality, and purposeful life in literature and film. C-L: Comparative Area Studies and Literature 121. One course. *Staff*

131. Introduction to Asian and African Linguistics. (SS) A survey of the basics of current linguistics and four language areas: East Asian, South Asian, Semitic, and African. Topics in phonology, morphology, and syntax of each language group, supplemented by a comparative historical and sociolinguistics perspective. No previous knowledge of linguistics or a foreign language required. C-L: Comparative Area Studies and Linguistics. One course. *Zhang*

137. Contemporary Culture in South Asia. (CZ) Everyday life in Indian cities and villages as represented in popular and intellectual media. Perspectives on cinema, television, and radio along with more traditional media. The fiction of Mohan Rakesh, the poetry of Muktibodh, the cinema of Aravindan and Satyajit Ray, the great Indian

epics on Indian television. Taught in English. C-L: Comparative Area Studies. One course. *Khanna*

138. The Media in Modern India. (CZ) The influence of modern media on Indian society. Topics include: traditional sources of new knowledge; the role of print media during colonization and in the postcolonial period; the emergence of radio; contemporary use of film and television. (Taught in summer program in Bombay.) One course. *Khanna*

160, 161. Introduction to the Civilizations of Southern Asia. (CZ) See C-L: Interdisciplinary Course 101, 102; also C-L: Comparative Area Studies; Cultural Anthropology 101, 102; History 193, 194; and Religion 160, 161. One course each. *Khanna or staff*

168. Francophone Literature. (AL, FL) Prerequisite: good knowledge of French. See C-L: French 168; also C-L: African and Afro-American Studies 138 and Comparative Area Studies. One course. *Mudimbe-Boyi*

171. Women and Creativity. (AL) Novels and short fiction from Egypt, Lebanon, Sudan, Iraq, Palestine, North Africa, and the Arabian Peninsula. Texts raising issues of identity formation in postcolonial societies, gender construction, and representation of conflict. C-L: Women's Studies. One course. *Saadawi*

173S. Women in Arab Literature. (AL) Comparative readings of major Arabophone and Francophone women's writings from the nineteenth century until today, including al-Saadawi, al-Shaikh, Andree Chedid, and Djébar. Taught in English. C-L: Literature 142S and Women's Studies. One course. *Cooke*

199. Asian and African Languages and Literature Honors Seminar. Open to seniors completing the certificate in Asian and African Languages and Literature (Arabic, Chinese, Hebrew, Hindi, Japanese, Korean, Persian, Swahili). Consent of instructor required. One course. *Staff*

205S. Gender and War. (CZ) See C-L: Interdisciplinary Course 205S; also C-L: History 205S. One course. *Cooke and Roland*

252. Special Topics in Asian and African Literatures. (AL) Topics vary each semester. One course. *Staff*

Courses Currently Unscheduled

107. Comparative Orthography. (CZ)

ARABIC (ARB)

1, 2. Elementary Arabic. (FL) Understanding, speaking, reading, and writing modern standard Arabic. Language laboratory. One course each. *Cooke or Cornell*

63, 64. Intermediate Arabic. (FL) Reading, composition, and conversation in modern standard Arabic. Readings include selections from the Qur'an, contemporary literature, and the Arabic press. One course each. *Cooke or Cornell*

100. North African Culture. (AL) Introduction to the culture of North Africa with special emphasis on the modern fiction of the area. (Taught in the summer program in Morocco, in English.) C-L: African and Afro-American Studies 103 and Comparative Area Studies. One course. *Cooke or Cornell*

125, 126. Advanced Arabic. (AL, FL) Readings in classical and contemporary fiction and nonfiction. Works include al-Jahiz, Ibn Arabi, Taha Husain, Ibn Battuta, Ghada al-Samman and *1001 Nights*. Prerequisite: Arabic 64 or equivalent. C-L: Comparative Area Studies. One course each. *Cooke or Cornell*

183, 184. Topics in Arabic. (AL, FL) Readings and other material, including films, television, and radio broadcasts. Exercises in composition. Prerequisite: Arabic 126 or consent of instructor. C-L: Comparative Area Studies. One course each. *Cornell*

191, 192. Independent Study. One course each. *Cooke or Cornell*

Courses Currently Unscheduled

161. Natural Space and Social Life in Morocco. (CZ)

CHINESE (CHN)

1, 2. Elementary Chinese. (FL) Introduction to speaking, understanding, reading, and writing modern standard Chinese (Mandarin, or *putonghua*, based on the Beijing dialect). One and one-half courses each. *Wang and staff*

1A. Abridged Elementary Chinese. (FL) Fundamentals of spoken and written modern standard Chinese (Mandarin). Intended for post-baccalaureate and summer session students. Consent of instructor required. One course. *Staff*

2A. Abridged Elementary Chinese II. (FL) Prerequisites: Chinese 1A and consent of instructor. One course. *Staff*

3. Literacy in Chinese. (FL) An alternative to Chinese 1, 2 for fluent speakers of modern standard Chinese (Mandarin), with little or no reading and writing ability, who wish to make sufficient progress in one semester to advance to Chinese 64 in the spring semester. One course. *Yao*

63, 64. Intermediate Chinese. (FL) Reading, oral practice, language laboratory. One and one-half courses each. *Yao*

125, 126. Advanced Chinese. (CZ, FL) Proficiency in speaking, aural comprehension, reading, and writing. Content drawn from newspaper articles, essays, and other readings concerning history, culture, and current political, social, and simple economic issues in China, Taiwan, and Hong Kong. Prerequisite: Chinese 63, 64 or equivalent. C-L: Comparative Area Studies. One course each. *Zhang*

141S. The Fantastic in Chinese Fiction in Translation. (AL) A survey of Chinese narrative convention with special emphasis on the genre of the fantastic in premodern fiction. Topics include the influence of Chinese literary conventions and religious modes on the fantastic in tales and full-length novels. C-L: Comparative Area Studies. One course. *Wang*

146. Fundamentals of the Structure of Chinese. (FL) Linguistic properties of Chinese and a comparison between English and Chinese; phonological, morphological, and syntactic aspects; the dialects and languages in China. Taught in English. No formal prerequisite, but some knowledge of Chinese preferred. C-L: Linguistics. One course. *Zhang*

148S. Literature and Revolution: From the May Fourth to the Post-Mao Era. (AL) The rise of the League of Left-Wing Writers, the sociopolitical role of May Fourth writers, the emergence of modern consciousness in the post-Mao period, the controversy over socialist alienation in the early 1980s, and the debate over Chinese postmodernism. Readings include works by Lu Xun, Mao Dun, Ding Ling, and modernist writers. Taught in English. C-L: Comparative Area Studies and Literature 148S. One course. *Wang*

183, 184. Topics in Modern Chinese. (FL) Readings and other material, including films, television, and radio broadcasts. Exercises in composition. Prerequisite: Chinese 125, 126, 127, 129, or consent of instructor. C-L: Comparative Area Studies. One course each. *Wang or Zhang*

191, 192. Independent Study. One course each. *Staff*

Courses Offered in the Duke Study in China Program at Beijing Teachers College and Nanjing University

111, 112. Intensive Progress in Chinese. (FL) One course each. *Staff*

127. Chinese Conversation and Composition. (FL) Discussion based on oral and written reports. Aural comprehension practice. One course. *Staff*

129. Advanced Readings in Chinese. (CZ, FL) Reading and discussion of selections from modern Chinese literature, expository prose, and the Chinese press. C-L: Comparative Area Studies. One course. *Staff*

193. Directed Study. Reading and research culminating in a paper, on a topic approved and supervised by the resident director. One course. *Staff*

Courses Currently Unscheduled

135, 136. Introduction to Modern Chinese Literature. (AL, FL)

142S. Masterpieces of Chinese Literature in Translation. (AL)

147. Literature and Popular Culture in Taiwan: 1960s to the Present. (CZ)

166S. The *I Ching*, or *Book of Changes*. (CZ)

171. The Novel in Modern China. (AL, FL)

182S. Classical Readings in Chinese Philosophy. (CZ, FL)

185S, 186S. Seminar on Contemporary China. (CZ, FL)

HEBREW (HEB)

1, 2. Elementary Modern Hebrew. (FL) Introduction to speaking, understanding, reading, and writing modern Hebrew. Language laboratory. C-L: Judaic Studies. One course each. *Staff*

63, 64. Intermediate Modern Hebrew. (FL) Reading, composition, conversation, and language laboratory. Prerequisite: Hebrew 1, 2 or equivalent. C-L: Judaic Studies. One course each. *Staff*

125, 126. Advanced Modern Hebrew. (AL, FL) Proficiency in reading, writing, and speaking. Readings will include an introduction to modern Hebrew literature and current Israeli journalism. Prerequisite: Hebrew 63, 64 or equivalent. C-L: Judaic Studies. One course each. *Staff*

181S. Hebrew Literature in Translation: The Golden Age. (AL) A survey of poetry and prose written in Spain and the surrounding areas from the eleventh to the fourteenth centuries. Topics include: wine and love songs, Arabic influences, and religious themes. Selections will be taken from the writings of Judah ha-Levi, Moshe Ibn Ezra, Shmuel ha-Nagid, Judah al-Harizi and others. C-L: Judaic Studies. One course. *Staff*

191, 192, 193, 194. Independent Study. One course each. *Staff*

HINDI-URDU (HIN)

1, 2. Elementary Hindi-Urdu. (FL) Conversation, basic grammar, and vocabulary; introduction to the Devanagari script and the reading of graded texts. Four hours of classroom work; two hours of language laboratory drill. One course each. *Khanna*

63, 64. Intermediate Hindi-Urdu. (FL) Reading, composition, and conversation. Four hours of classroom work, two hours of language drill. Prerequisites: Hindi-Urdu 1 and 2. One course each. *Khanna*

125, 126. Advanced Hindi. (FL) Proficiency in reading, writing, and speaking. Prerequisite: Hindi 63, 64 or equivalent. One course each. *Khanna*

191, 192. Independent Study. Directed reading and research. Open only to students with prior knowledge of Hindi-Urdu. One course each. *Khanna*

JAPANESE (JPN)

1, 2. Elementary Japanese. (FL) Introduction to speaking, understanding, reading, and writing. One course each. *Nagai and staff*

10-11. Intensive Elementary Japanese. (FL) Intensive introduction to speaking, listening, reading, and writing Japanese. Offered only in the summer, in a nine-week special session. Twenty hours a week—equivalent to Japanese 1 and 2. Two courses. *Staff*

63, 64. Intermediate Japanese. (FL) Practice on advanced spoken and written patterns; reading and discussion. One course each. *Endo and staff*

125, 126. Advanced Japanese. (AL, FL) Readings and other materials, including video. Exercises in composition and conversation. C-L: Comparative Area Studies. One course each. *Staff*

175. Structure of Japanese. (FL) Syntactic and semantic analysis of Japanese within the framework of current linguistic theory. Taught in English. Prerequisites: Japanese 1 and 2. C-L: Comparative Area Studies and Linguistics. One course. *Nagai*

183, 184. Topics in Japanese. (AL, FL) Readings and other material, including television and radio broadcasts. Exercises in composition. Consent of instructor required. C-L: Comparative Area Studies. One course each. *Nagai*

191, 192. Independent Study. One course each. *Staff*

193, 194. Independent Study. One course each. *Staff*

Courses Currently Unscheduled

100. Cultural Identification and Self-Identification in Modern Japan. (AL)

161. Modern Japanese Fiction in Translation. (AL)

162. Premodern Japanese Literature. (AL)

KOREAN (KOR)

1, 2. Elementary Korean. (FL) Introduction to speaking, understanding, reading, and writing Korean. One course each. *Staff*

14. Intensive Korean. (FL) Accelerated introduction to Korean, combining in one semester the work of Korean 1, 2; includes speaking, understanding, reading, and writing. Two courses. *Staff*

63, 64. Intermediate Korean. (FL) Spoken and written Korean. One course each. *Staff*

125, 126. Advanced Korean. (CZ, FL) Proficiency in speaking, aural comprehension, reading, and writing. Prerequisite: Korean 63, 64 or equivalent. C-L: Comparative Area Studies. One course each. *Staff*

191, 192. **Independent Study.** (FL) One course each. *Staff*

PERSIAN (PER)

1, 2. **Elementary Persian.** (FL) Introduction to spoken and literary Persian: understanding, speaking, reading, and writing. Language laboratory drill. One course each. *Lawrence*

63, 64. **Intermediate Persian.** (FL) Four hours of classroom work. Advanced reading and composition in classical Persian. Prerequisite: elementary Persian. One course each. *Lawrence*

101, 102. **Introduction to Persian Literature.** (AL, FL) An introduction to classical Persian literature through the reading and translation of selected prose and poetry texts. Prerequisites: Persian 64 or the equivalent, and consent of instructor. One course each. *Lawrence*

SWAHILI (SWA)

1, 2. **Elementary Swahili.** (FL) Swahili language and culture with emphasis on conversation. Intensive work in language laboratory; drill sessions with native speakers. One course each. *O'Barr*

63, 64. **Intermediate Swahili.** (FL) Continuation of Swahili 1 and 2. Emphasis on contemporary Swahili literature. One course each. *O'Barr*

191, 192. **Independent Study.** One course each. *O'Barr*

Astronomy

For courses in astronomy, see Physics.

Biochemical Engineering

For courses in biochemical engineering, see Engineering (School); also see Biology major.

Biochemistry

For courses in biochemistry, see Medicine (School)—Graduate (School) Basic Science Courses Open to Undergraduates; also see Biology and Chemistry majors.

Biological Anthropology and Anatomy (BAA)

Professor Kay, *Chair*; Associate Professor Van Schaik, *Director of Undergraduate Studies*; Professors Cartmill, Glander, Hylander, Simons, and Terborgh; Associate Professors Roth and Smith; Assistant Professors Bassett, Maas, Pope, and White; Professor Emeritus La Barre; Associate Professor Emeritus Duke

A major is available in this department.

Biological Anthropology and Anatomy is an interdisciplinary department centering on the origin and evolution of human beings and their close biological relatives. The department and its course offerings have three general focuses: primate behavior and ecology, primate paleontology, and functional and comparative anatomy. Significant opportunities for independent research are found at the Duke Primate Center, which houses a unique and diverse range of nonhuman primates, especially prosimians from Madagascar. Advanced students can study original fossils and casts at the Primate Center and in the department's laboratories in the Medical Center, which also afford opportunities to study comparative anatomy from an adaptive and evolutionary perspective. Students interested in the Primatology Program should be aware that Biolog-

ical Anthropology and Anatomy 93D is a program requirement. For further information on the Primatology Program contact the program chair at the department.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

93. Introduction to Biological Anthropology. (NS) Origins and distribution; primate evolution; a survey of human paleontology and human biology, prehistory, and language; and the origins of human social organization and culture. One course. *Staff*

93D. Introduction to Biological Anthropology. (NS) Same as Biological Anthropology and Anatomy 93 except instruction is provided in two lectures and one small laboratory meeting each week. One course. *Staff*

132. Human Evolution. (NS) Evolutionary biology of the primates. Anatomical and behavioral adaptations and phylogeny of fossils and living primates including *Homo sapiens*. Prerequisites: Biological Anthropology and Anatomy 93 or equivalent. One course. *Cartmill, Glander, or Simons*

133. The Human Body. (NS) Human gross anatomy seen from a functional and evolutionary perspective. Laboratory involving study of prosected cadavers and other anatomical preparations. Prerequisites: Biological Anthropology and Anatomy 93. One course. *Cartmill and White*

143. Primate Ecology. (NS) A survey of primate ecology and behavior. Prerequisites: Biological Anthropology and Anatomy 93 or consent of instructor. One course. *Glander, Simons, Van Schaik, and White*

144L. Primate Social Behavior. (NS) Evolutionary adaptation of communication, aggression, parental behavior, and sexual behavior. One course. *Glander or White*

146. Sociobiology and Gender. (NS) Sociobiological theory reviewed and applied to the social behavior of primates, including humans. Emphasis on sex differences. Prerequisites: Biological Anthropology and Anatomy 93. One course. *Van Schaik*

151. Anatomy of the Lower Extremities. (NS) Introduction to the functional anatomy of the lower extremities. Does not count for biological anthropology and anatomy major requirements. Consent of instructor required. One course. *Bassett*

172S. Primate Anatomy. (NS) The comparative anatomy of primates from the perspective of adaptation and phylogeny. Laboratory includes some dissection or prosection of human and nonhuman primates. One course. *Kay or staff*

180. Current Issues in Biological Anthropology and Anatomy. (NS) Selected topics in methodology, theory, or area. One course. *Staff*

180S. Current Issues in Biological Anthropology and Anatomy. (NS) Same as Biological Anthropology and Anatomy 180 except instruction is provided in seminar format. One course. *Staff*

183. Primate Social Complexity and Intelligence. (NS) Information on primate social behavior and cognition used to examine ideas on the origins and functions of primate intelligence. Topics include communication, "ape language," alliances and reciprocity, deception and social manipulation, and the extent of awareness inferable from behavior in the wild and from experiments in captivity. One course. *Staff*

184. Conservation Biology of Primates. (NS) Introduction to the main concepts of conservation biology, both at the species and community level, using primate examples. Relevant aspects of primate distribution, ecology, and demography; threats to primate populations and their ecosystems, conservation strategies, and actual case studies. One course. *Van Schaik*

185. Current Issues in Primatology. (NS) Selected topics in primate behavior, ecology, and conservation. Consent of instructor required. One course. *Staff*

186S. Research Internship in Primatology. (NS) Consent of instructor required. See C-L: Interdisciplinary Course 186S. One course. *Glander or White*

187S. Senior Seminar in Primatology. (NS) Consent of instructor required. See C-L: Interdisciplinary Course 187S. One course. *Glander or White*

193. Independent Study. Directed reading and research. Open only to qualified seniors, with consent of Director of Undergraduate Studies. One course. *Staff*

195S, 196S. Senior Seminar. Prerequisites: BAA 93, a 100-level course in biological anthropology and anatomy, and consent of Director of Undergraduate Studies. One course each. *Staff*

For Seniors and Graduates

238. Functional and Evolutionary Morphology of Primates. (NS) History and functional significance of locomotor and feeding adaptations, craniofacial morphology, sense organs, and reproductive systems in primates, including *Homo sapiens*. Consent of instructor required. One course. *Cartmill and Kay*

244L, S. Comparative Primate Ecology. (NS) Comparisons of the evolutionary ecology of prosimians, monkeys, and apes. With field methods. Prerequisites: Biological Anthropology and Anatomy 93 and 143 recommended. One course. *Glander or White*

245S. Primate Social Evolution. (NS) Ecological determinants of, and biological constraints on, social strategies and systems. Emphasis on primates. Prerequisites: Biological Anthropology and Anatomy 93; 143, 144L, or 146; or consent of instructor. One course. *Van Schaik*

246S. The Primate Fossil Record. (NS) Evolution of humans and other primates as inferred from fossil remains. Prerequisite: a course in human evolution. One course. *Simons*

247. The Hominid Fossil Record. (NS) Origin and successive stages of development of human ancestors. Detailed analysis of adaptive types and cultural developments. Personalities and current controversies in the study of hominid paleontology. Prerequisites: Biological Anthropology and Anatomy 93, 132, or consent of instructor. One course. *Simons*

248S. Evolution of Mammals. (NS) The origin, adaptive radiation, and phylogenetic relationships of mammals, as inferred from the fossil record. Consent of instructor required. One course. *Maas*

250. Biometry. (QR) A practically oriented overview of the statistical analysis of biological data. Topics include data collection and experimental design, methods and techniques of data organization, use of computing programs and packages, applications of appropriate parametric and nonparametric statistical techniques, assumptions and problems encountered with biological data analysis, and interpretation of results. Prerequisite: Mathematics 136, Psychology 117, Sociology 133, Statistics 10D, 110, 112, 114, 213, or equivalent. C-L: Environment 253. One course. *Gerhart and White*

280S, 281S. Seminar in Selected Topics. (NS) Special topics in methodology, theory, or area. Consent of instructor required. One course each. *Staff*

287S. Macroevolution. (NS) Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolu-

tionary trends. Prerequisites: Biology 21L and 22L or equivalents. C-L: Biology 287S. One course. *Mishler and Roth*

289. Comparative Mammalian Anatomy. (NS) A practical survey of anatomical diversity in mammals. An emphasis on dissections of a broad variety of mammals. A broader perspective on specific anatomical features provided in the lectures. One course. *Staff*

290. Pattern and Process in Vertebrate Development. (NS) Research results on developmental processes applied to classic problems of comparative vertebrate biology. Specific focus to vary, but to include cell differentiation and migration, induction, cell-cell interaction and cell mechanics as well as craniofacial morphogenesis, development and evolution, developmental constraints and comparative embryology. Prerequisites: course in comparative or human anatomy and consent of instructor. C-L: Biology 290. One course. *Smith*

292S. Topics in Morphology and Evolution. (NS) Various aspects of vertebrate morphology and evolution, including major historical approaches to the interpretation of morphology; the evolution, development, and function of specific morphological structures; and patterns of vertebrate evolution. Consent of instructor required. One course. *Smith*

COURSES CURRENTLY UNSCHEDULED

293, 294. Evolutionary Theory. (NS)

THE MAJOR

For the A.B. Degree

Prerequisite. Biological Anthropology and Anatomy 93 or 93D.

Corequisites. Cultural Anthropology 94, 94D, or 100; and Biology 21L or 22L or 74L.

Major Requirements. Eight courses are required, not including the above prerequisites and corequisites, distributed in the following manner:

—Biology Anthropology and Anatomy 132.

—At least four courses selected from the Biological Anthropology and Anatomy present course listings (with the exception of Biological Anthropology and Anatomy 151).

The remaining courses may be selected from Biological Anthropology and Anatomy courses numbered 100 or above or from approved courses in other social and biological sciences departments (for example, Biology 108L, 110L, 149, 201L, S, 215, 234S, 237L, and 287S; Psychology 103, 111, and 150S.)

For the B.S. Degree

Prerequisite. Biological Anthropology and Anatomy 93 or 93D.

Corequisites. Biology 21L or 22L or 74L, or equivalent; Chemistry 11L, 12L, and 151L; Mathematics 31 and 32; Physics 51L and 52L, or 53L and 54L.

Major Requirements. Eight courses are required in the biological and geological sciences, not including the above prerequisites and corequisites. Of these eight courses, at least five courses must be selected from the Biological Anthropology and Anatomy present course listings; up to three courses in other biological sciences, psychology, or geology, approved by the advisor. One of these eight courses must include related laboratory/field experience; an independent study course may be counted toward the laboratory/field experience requirement. At least one of the courses must concern statistics or quantitative methods (Biological Anthropology and Anatomy 250, Statistics 100 level or Psychology 117, or equivalent). At least two of these eight courses must be

at the 200 level. Geology 72 is strongly encouraged for students with interests in paleontology.

Honors/Distinction. Qualified majors are encouraged to participate in special work leading to graduation with distinction in biological anthropology and anatomy. See the section on honors in this bulletin for general requirements. Any major with a B+ average (3.3 gpa) in biological anthropology and anatomy courses and with a B average (3.0 gpa) in all courses is eligible. Students who desire to undertake honors work should request a member of the biological anthropology and anatomy faculty to recommend their names to the Director of Undergraduate Studies. To receive departmental honors a major must complete a paper involving significant independent research or scholarship and pass an oral examination on the paper conducted by an appointed committee of faculty members, at least two of whom should be in biological anthropology and anatomy. Normally, students will prepare their papers over the course of the senior year working in close collaboration with their committees and receiving on the average two course credits in independent study for the work.

Biology (BIO)

Faculty in Botany: Professor Searles, *Chair*; Associate Professor Mishler, *Associate Director of Undergraduate Studies in Biology*; Professors Antonovics, Barber, Boynton, Christensen, W. Culberson, Ramus, Reynolds, Schlesinger, Siedow, Stone, Strain, Terborgh, White, and R. Wilbur; Associate Professor Knoerr; Assistant Professors Baldwin, Clark, Dong, B. Kohorn, Sun, and Vilgalys; Professors Emeriti Anderson, Billings, Hellmers, Kramer, Naylor, and Philpott; Research Professors C. Culberson and Patterson; Adjunct Professor Osmond; Adjunct Associate Professors Funk, Harris, Kress, Lacey, Wagner, and Zimmer; Lecturers Armaleo and Bush

Faculty in Zoology: Professor H. Nijhout, *Chair*; Professor Fluke, *Director of Undergraduate Studies in Biology*; Professors Barber, Brandon, Forward, Gillham, Klopfer, Laurie, Livingstone, McClay, Nicklas, Rausher, Simons, Staddon, Sutherland, Terborgh, Tucker, Uyenoyama, Vogel, Wainwright, and Ward; Associate Professors Rittschof, Roth, and Smith; Assistant Professors Crenshaw, Fehon, Morris, and Nowicki; Professors Emeriti Bailey, Bookhout, Gregg, Schmidt-Nielsen, and K. Wilbur; Assistant Professor of the Practice Motten; Research Assistant Professor Roach; Adjunct Professor Schmidt-Koenig; Adjunct Associate Professor M. Nijhout; Instructor Mercer

A major is available in biology.

The biology courses and the biology major are cooperatively administered by the Department of Botany and the Department of Zoology. Additional courses in biosciences are offered by the departments of Biological Anthropology and Anatomy, Chemistry, and Psychology in Trinity College of Arts and Sciences; by the basic sciences departments in the School of Medicine; and by the schools of Engineering and of the Environment.

Biology 21L and 22L constitute the normal introductory courses for students planning to major in the biological sciences and are prerequisites for intermediate and advanced courses in biology. The two courses may be taken in either order, and students majoring in biology may take their second course in the sequence concurrently with an intermediate level course, as appropriate. For nonmajors, either course, or both, may count for the area requirement in the natural sciences.

10L: Marine Biology. (NS) Physical and chemical characteristics of marine ecosystems and the functional adaptations of marine organisms to these systems. Lectures, field trips, and laboratories. For students not majoring in a natural science. (Given at Beaufort.) C-L: Marine Sciences. One course. *Staff*

19. General Biology. Credit for advanced placement on the basis of the College Board Examination in biology. Equivalent to Biology 21L and 22L as prerequisite. One course.

21L. Introduction to Organismal and Environmental Biology. (NS) The basic principles of genetics, population genetics, evolution, ecology, and physiology of animals and plants. The diversity and phylogeny of unicellular organisms and of plants. May be taken before or after Biology 22L. One course. *Staff*

22L. Introduction to Cellular and Developmental Biology. (NS) The basic principles of cell biology, photosynthesis, metabolism, molecular biology, immunology, and development of animals and plants. The diversity and phylogeny of animals. May be taken before or after Biology 21L. One course. *Staff*

43D. Ecology and Society. (NS) Ecological concepts and their application to human society. Intended for nonscience majors. One course. *Staff*

45S. Structure. The structural design principles that underlie function, failure, and fancy in natural and manmade things. Gaps and connections between science and art. Lectures and tasks for minds and hands on worldly designs. Does not count toward the areas of knowledge requirements. C-L: Institute of the Arts 20S. One course. *Wainwright*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

50. Life's Beginnings. (NS) Cells, molecules, and evolution from the start. The origin and evolution of life on earth as a case study in science as a human enterprise and as a way of knowing. Intended for non-biology majors. One course. *Nicklas*

53. Introductory Oceanography. (NS) Basic principles of physical, chemical, biological, and geological oceanography. Fee for required field trip to the Marine Laboratory. C-L: Geology 53. One course. *Pilkey (geology) and Searles*

90. Plants and Civilization. (NS) The biological nature of crop plants, the world's major economic plants, and the origins and evolution of agriculture. One course. *W. Culberson or R. Wilbur*

92S. Social Implications of Genetics. (NS) The positive and negative implications of genetics for society. Development of the field of human genetics in parallel with the science as a whole and investigation of the advances that have occurred in the diagnosis, treatment, and prevention of genetic disease. Open only to students in the FOCUS Program. One course. *Gillham*

93S. Changing Human Environments. (NS) General patterns of change in global environments during the past four million years explored in relation to prehistoric and historic evolution. The reciprocal relationships between landscape and global ecological change and human land use. The potential future role of these relationships. Open only to students in the FOCUS Program. One course. *Antonovics*

96D. Human Sex and Sexuality. Anatomical, physiological, and psychological aspects of sexuality. Weekly lectures by specialists. Does not satisfy major or area of knowledge requirements. Pass/fail grading only. Half course. *Klopper and staff*

100. Perspectives on Living Systems. (NS) For upperclass students not intending majors in a biological science. One course. *Staff*

102. Trees and Shrubs of North Carolina. (NS) Identification and natural history of the trees, shrubs, and woody vines. Emphasis on those cultivated or occurring naturally in North Carolina. One course. *R. Wilbur*

103L. General Microbiology. (NS) Classical and modern principles of the structure, physiology, and genetics of microorganisms and their roles in human affairs. Prerequisite: one course in a biological science or consent of instructor. One course. *Vilgalys*

108L. Developmental and Comparative Anatomy of Vertebrates. (NS) The embryology, anatomy, and evolutionary development of vertebrate organ systems. Prerequisites: Biology 21L and 22L. One course. *Staff*

110L. Ecology. (NS) Physical, chemical, and biological processes that determine the distribution and abundance of plants and animals, emphasizing physiological responses, population dynamics, species interaction, biogeography, nutrient cycling, and energy flow through food webs. Laboratory includes fieldwork. Prerequisites: Biology 21L and 22L; and Mathematics 31. One course. *Livingstone and Schlesinger*

113L. Behavioral Ecology. (NS) How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. (Given at Beaufort.) Prerequisites: Biology 21L and 22L. C-L: Marine Sciences. One course. *Rubenstein (visiting summer faculty)*

114L. Biological Oceanography. (NS) Physical, chemical, and biological processes of the oceans, emphasizing special adaptations for life in the sea and factors controlling distribution and abundance of organisms. Laboratory emphasis. One course (spring); one and one-half courses (summer). (Given at Beaufort.) Prerequisites: Biology 21L and 22L. C-L: Environment 292L and Marine Sciences. Variable credit. *Ramus or staff*

115L. The Ocean's Role in Climate. (NS) Examination of how biogeochemical processes in the oceans regulate chemical properties of the atmosphere and in turn control the thermal dynamics of the earth system, with emphasis on ocean processes that regulate the concentration of the greenhouse gasses in the earth's atmosphere, providing a basic understanding of the earth's climate system. (Given at Beaufort.) Prerequisite: one year of biology or geology; Biology/Geology 53 recommended. C-L: Marine Sciences. One and one-half courses. *Barber*

117L. Biology of Marine Macrophytes. (NS) Physiology and ecology of seaweeds, seagrasses, marshgrasses, and mangroves. Biological flux of carbon and nutrients in coastal seas. Ecological consequences of photosynthetic adaptations. (Given at Beaufort.) Prerequisites: Biology 21L and 22L; and Chemistry 11L, 12L or equivalent. C-L: Marine Sciences. One course. *Ramus*

120. Principles of Evolution. (NS) Evidence for evolution; mechanisms of micro- and macro-evolutionary change. Genetic change in populations. Ecological, behavioral, molecular forces influencing genetic change. Speciation; phylogenetic reconstruction. Prerequisite: Biology 21L. One course. *Antonovics, Mishler, Rausher, or Roth*

123. Analysis of Ocean Ecosystems. (NS) The history, utility, and heuristic value of the ecosystem; ocean systems in the context of Odum's ecosystem concept; structure and function of the earth's major ecosystems. (Given at Beaufort.) Prerequisite: one year of biology, one year of chemistry, or consent of instructor. C-L: Environment 293 and Marine Sciences. One course. *Barber*

140L. Plant Diversity. (NS) Major groups of living plants, their evolutionary origins and phylogenetic relationships. Fee for field trip. Prerequisite: introductory biology. One course. *Mishler, Searles, or R. Wilbur*

142L. Plant Systematics. (NS) Surveys major groups. Principles of vascular plant taxonomy with practice in identification of local flora. Lectures, laboratories, and field trips. One course. *R. Wilbur*

149. Comparative Biomechanics. (NS) The structure and operation of organisms in relation to the mechanics of solids and fluids. Not open to students who have taken Biology 249. Prerequisites: Mathematics 31 and Physics 51L or equivalents. One course. *Vogel and Wainwright*

150L. Physiology of Marine Animals. (NS) Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. (Given at Beaufort.) Prerequisites: Biology 21L and 22L; and chemistry. C-L: Marine Sciences. One course. *Forward*

151L. Principles of Animal Physiology. (NS) Functional aspects of respiration, circulation, neural and hormonal coordination, water balance, metabolism, thermoregulation, and responses to special environments. Prerequisites: Biology 22L and Chemistry 12L. One course. *Crenshaw or Tucker*

152. Plant Physiology. (NS) Principal physiological processes of plants, including respiration, photosynthesis, water relations, and factors associated with plant morphogenesis. Prerequisites: Biology 21L and one year of chemistry; organic chemistry is desirable. One course. *Siedow*

154. Principles of Neurobiology. (NS) Introduction to neuroscience, including basic physiology, microstructure, and anatomy of neural tissues; mechanisms of neuronal development and integration; sensory-motor control; the neural foundations of animal behavior, and the evolution of nervous systems. Prerequisites: Biology 21L and 22L, and Chemistry 12L or equivalent. C-L: Psychology 135. One course. *Nowicki*

155L. Biochemistry of Marine Animals. (NS) Functional, structural, and evolutionary relationships of biochemical processes of and importance to marine organisms. (Given at Beaufort.) Prerequisites: Biology 21L and 22L; Chemistry 11L, 12L. C-L: Marine Sciences. One course. *Rittschof*

160. Principles of Cell Biology. (NS) Structure and function of organelles, metabolism, and regulatory mechanisms. Prerequisites: Biology 22L and Chemistry 12L. One course. *Kohorn, McClay, or M. Nijhout*

164. Developmental Biology. (NS) Principles and problems of development and differentiation. Embryology, molecular and cellular mechanisms of determination, embryonic induction, and differentiation; developmental genetics, morphogenesis, and pattern formation. Attention to current literature. Prerequisite: Biology 160. C-L: The University Program in Genetics. One course. *Fehon*

169L. Marine Communities. (NS) Dynamics of marine communities in the context of current ecological theory. Life history strategies, competition, predation, diversity, and stability; detailed considerations of benthic and pelagic communities. (Given at Beaufort.) Prerequisites: Biology 21L and 22L, and Mathematics 31. C-L: Environment 294L and Marine Sciences. One course. *Gerhart*

176L. Marine Invertebrate Zoology. (NS) Structure, function, and development of invertebrates collected from estuarine and marine habitats. Not open to students who have taken Biology or Zoology 274L. (Given at Beaufort.) One course (fall); one and one-half courses (summer). Prerequisites: Biology 21L and 22L. C-L: Environment 295L and Marine Sciences. Variable credit. *Kirby-Smith*

180. Principles of Genetics. (NS) Structure and properties of genes and chromosomes in individual organisms and in populations. Prerequisites: Biology 21L and 22L. C-L: The University Program in Genetics. One course. *Antonovics, Boynton, Gillham, and Laurie*

184L. Experimental Cell and Molecular Biology. (NS) Experimental approaches to contemporary questions in cell and molecular biology. Practical laboratory training in molecular genetics, protein chemistry and other methods used in the rapidly developing field of biotechnology. Experiments include cloning and sequencing genes, characterizing gene regulation and exploring protein structure/function relationships and subcellular localization. Prerequisite: Biology 160 or 180. One course. *Dong, Kohorn, Siedow, or Sun*

191, 192. Independent Study. (NS) For junior and senior majors with consent of Director of Undergraduate Studies and supervising instructor. Three courses of 191, 192, 193T, and 194T, maximum. Variable credit. *Staff*

193T, 194T. Tutorial. (NS) For junior and senior majors with consent of Director of Undergraduate Studies and supervising instructor. Three courses of 191, 192, 193T, and 194T, maximum. Variable credit. *Staff*

195S, 196S. Seminar in Biology. (NS) Variable credit. *Staff*

199S. The Changing Biosphere: Past, Present, and Future. (NS) Consent of instructor required. See C-L: Distinguished Professor Course 199S. One course. *Billings*

For Seniors and Graduates

201L, S. Animal Behavior. (NS) Survey of past developments and current controversies in animal behavior. Extensive readings, followed by individual experimental or descriptive projects in the laboratory or field (or Primate Center). Recommended background: Biology 21L and 22L, Biology 151L, and statistics, or equivalents. One course. *Klopfer*

203L. Marine Ecology. (NS) Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent research projects. Topics include characteristics of marine habitats, adaptation to environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. (Given at Beaufort.) Prerequisite: none; suggested—introductory ecology, invertebrate zoology, or marine botany. C-L: Environment 219L and Marine Sciences. One and one-half courses. *Gerhart*

206S. Controversies in Biology. (NS) A contentious theme for reading, discussion, and an individual or joint paper. Illustrative past topics: the nature of the creative process, causality in biological thought, the lack of political impact of many scientific developments. Open to nonmajors. One course. *Klopfer*

209L. Lichenology. (NS) Morphology, systematics, and biological and ecological implications of the lichens. Collection and identification of specimens and the use of lichen chemistry in taxonomy. One course. *C. Culberson and W. Culberson*

210L. Bryology. (NS) Morphological, systematic, and ecological characteristics of mosses and liverworts. One course. *Mishler*

212L, S. Phycology. (NS) Morphological and ecological characteristics of common freshwater and marine algae and principles of their classification. One course. *Searles*

215. Tropical Ecology. (NS) Ecosystem, community, and population ecology of tropical plants and animals with application to conservation and sustainable development. Prerequisite: a course in general ecology. C-L: Environment 217. One course. *Terborgh*

216L. Limnology. (NS) Lakes, ponds, and streams; their origin, development, geochemistry, energy balance, productivity, and the dynamics of plant and animal

communities. Laboratory includes field trips. Offered biennially. Prerequisites: Biology 21L and 22L; and Chemistry 12L and Mathematics 32 and physics; or equivalents; or consent of instructor. One course. *Livingstone*

218L. Barrier Island Ecology. (NS) An integration of barrier island plant and animal ecology within the context of geomorphological change and human disturbance. Topics include: barrier island formation and migration, plant and animal adaptations, species interactions, dune succession, maritime forests, salt marshes, sea level rise, conservation policy, and restoration ecology. Field trips to many of the major North Carolina barrier islands. Strong emphasis on field observation and independent research. (Given at Beaufort.) Prerequisite: introductory biology; suggested: course in botany or ecology. C-L: Environment 218L and Marine Sciences. One and one-half courses. *Evans, Peterson, and Wells (visiting summer faculty)*

219L. Benthic Marine Algae. (NS) Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and fieldwork in ocean and estuaries. (Given at Beaufort.) Prerequisite: introductory biology; plant diversity recommended. C-L: Environment 296L and Marine Sciences. One course. *Schneider (visiting summer faculty)*

220L. Mycology. (NS) Survey of the major groups of fungi with emphasis on life history and systematics. Field and laboratory exercises. One course. *Vilgalys*

222L. Entomology. (NS) The biology of insects: diversity, development, physiology, and ecology. Field trips. Prerequisites: Biology 21L and 22L or equivalents. One course. *H. Nijhout*

232. Microclimatology. (NS) Introduction to the micrometeorological processes. Discussion of the integration of these processes and the resulting microclimates in the rural (forest, field, and water surface) and urban environments. Methods for modification of the microclimate. C-L: Environment 232. One course. *Knoerr*

234S. Problems in the Philosophy of Biology. (NS) Consent of instructor required. See C-L: Philosophy 234S. One course. *Brandon*

237L. Systematic Biology. (NS) Theory and practice of identification, species discovery, phylogeny reconstruction, classification, and nomenclature. Prerequisites: Biology 21L and 22L or equivalents. One course. *Mishler*

241. Field Botany. (NS) Identification and recognition of the vascular flora of the Carolinas. Frequent field trips to representative habitats. Prerequisite: introductory plant identification course or consent of instructor. One course. *R. Wilbur*

243S. Classification of Angiosperms. (NS) The characteristics and phylogenetic relationships of large and important families of angiosperms with emphasis upon the systems of Cronquist and Thorne. Prerequisite: Biology 142L or equivalent. One course. *Baldwin or R. Wilbur*

244. Principles of Immunology. (NS) An introduction to the molecular and cellular basis of the immune response. Topics include anatomy of the lymphoid system, lymphocyte biology, antigen-antibody interactions, humoral and cellular effector mechanisms, and control of immune responses. Prerequisites: Biology 160 and Chemistry 151L or equivalents. C-L: Immunology 244. One course. *Kostyu (immunology), McClay, and staff*

249. Comparative Biomechanics. (NS) The structure and operation of organisms in relation to the mechanics of solids and fluids, including readings from the primary literature. Not open to students who have taken Biology 149. Prerequisites: Mathematics 31 and Physics 51L or equivalents. One course. *Vogel and Wainwright*

256L. S. Plant Biosystematics. (NS) Descriptive and experimental procedures used to assess systematic implications of plant evolution. Laboratory, discussion, and field-oriented problems. Prerequisites: basic courses in systematics and genetics. One course. *Baldwin*

257L. Molecular Systematics and Evolution. (NS) Descriptive and experimental procedures used to assess evolutionary diversity for analysis of population genetics and systematic relationships. Laboratory problems, discussion, and individual research projects. Prerequisites: basic course work in systematics, evolution, and genetics. One course. *Vilgalys*

259L. Laboratory in Biomechanics. (NS) Introduction to instruments used in investigations of solid and fluid biomechanics. Exercises and individual projects. Prerequisites: Biology 249 and consent of instructor. One course. *Vogel and Wainwright*

261. Photosynthesis. (NS) Principles of photosynthesis: developmental, mechanistic, regulatory, and ecological aspects of the photosynthetic process. Prerequisite: Biology 152 or equivalent. One course. *Siedow*

262. Biology of Parasitism. (NS) How parasites, from viruses through vertebrates, have solved the special problems associated with their dependence on other organisms. Emphasis on life cycles, host-parasite interactions, and experimental parasitology. Intended for seniors. Prerequisites: Biology 22L and 160 or equivalents. One course. *M. Nijhout*

265L. Physiological Plant Ecology. (NS) The physiological approach to interpreting adaptation in plants, with emphasis on terrestrial seed plants. Prerequisites: Biology 110L and 152 or equivalents. One course. *Strain*

267L. Community Ecology. (NS) Mechanisms that determine the distribution and abundance of plants and animals: geology, climate, physiography, soils, competition, predation, and history. Lectures focus on ecological principles. Seminars and weekend field trips. Prerequisites: an introductory ecology course and consent of instructor. One course. *Christensen*

269. Advanced Cell Biology. (NS) Structural and functional organization of cells and their components with emphasis on current research problems and prospects. Prerequisite: introductory cell biology or consent of instructor. C-L: Cell and Molecular Biology, Cell Biology 269, Immunology 269, and Microbiology 269. One course. *Nicklas and staff*

272. Biogeochemistry. (NS) Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and surficial processes. Prerequisite: Chemistry 12L or equivalent. C-L: Geology 272. One course. *Schlesinger*

274L. Biology of Marine Invertebrates. (NS) Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips. Not open to students who have taken Biology 176L. (Given at Beaufort.) Prerequisites: Biology 21L and 22L or equivalents. C-L: Environment 297L and Marine Sciences. One and one-half courses. *Staff*

281. DNA, Chromosomes, and Evolution. (NS) The relationship of chromosome and DNA-sequence organization with evolution; karyotype changes and speciation; repetitive DNA, split genes, transposable elements, and evolutionary mechanisms; phylogeny reconstruction; evolution of mitosis and the chromosome cycle. Prerequisite: an introductory course in genetics or cell or molecular biology, or consent of instructor. C-L: The University Program in Genetics. One course. *Laurie and Nicklas*

283. Molecular Genetics of Organelles. (NS) Genetics, biochemistry, and molecular biology of the organelles of eukaryotic cells, and cellular symbionts. Emphasis on recent literature. Prerequisite: introductory genetics. C-L: The University Program in Genetics. One course. *Boynton and Gillham*

285S. Ecological Genetics. (NS) Interaction of genetics and ecology and its importance in explaining the evolution, diversity, and distribution of plants and animals. Prerequisites: Biology 180 and 286 or equivalents. C-L: The University Program in Genetics. One course. *Antonovics*

286. Evolutionary Mechanisms. (NS) Population ecology and population genetics of plants and animals. Fitness concepts, life history evolution, mating systems, genetic divergence, and causes and maintenance of genetic diversity. Prerequisites: Biology 21L and 22L, and Biology 180 or equivalents. C-L: The University Program in Genetics. One course. *Antonovics and Uyenoayama*

287S. Macroevolution. (NS) Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisites: Biology 21L and 22L or equivalents. C-L: Biological Anthropology and Anatomy 287S. One course. *Mishler and Roth*

288. Mathematical Population Genetics. (NS) Principles of formulation and analysis of dynamic mathematical models of genetic evolution. Rotating topics include: mating systems, sex ratio, stochastic processes. Prerequisites: calculus; statistics and linear algebra recommended. C-L: The University Program in Genetics. One course. *Uyenoyama*

289. Methods in Morphometrics. (QR) Techniques for the acquisition and analysis of quantitative data for describing and comparing biological form. Topics include: image capture and analysis, two- and three-dimensional digitization, and multivariate and geometric techniques such as allometric analysis, outline and landmark-superposition methods, and deformation models. Background in statistics and linear algebra recommended. One course. *Mercer*

290. Pattern and Process in Vertebrate Development. (NS) Prerequisites: course in comparative or human anatomy and consent of instructor. See C-L: Biological Anthropology and Anatomy 290. One course. *Smith*

295S, 296S. Seminar. (NS) Variable credit. *Staff*

COURSES CURRENTLY UNSCHEDULED

74L. Introductory Animal Diversity. (NS)

85. Ecology and Natural History of North America. (NS)

145. Physical Radiations and Biological Significance. (NS)

179T. Tutorial in Functional Morphology. (NS)

221S. Topics in Advanced Mycology. (NS)

226L. Ichthyology. (NS)

245S. Radiation Biology. (NS)

247S. Photobiology. (NS)

THE MAJOR

The Bachelor of Arts and the Bachelor of Science degrees are offered with a major in biology or in an individually designed interdepartmental concentration approved by

the Director of Undergraduate Studies in Biology. Information about the biology major may be obtained in the office of the Director of Undergraduate Studies.

For the A.B. Degree

This degree program is the general liberal arts major program. Students contemplating a career in biological or biomedical sciences should elect the program leading to the B.S. degree.

Prerequisite. Biology 21L, 22L or equivalent.

Corequisites. Chemistry 11L, 12L; Mathematics 31, 32; plus three science-related courses outside the biological sciences selected from an approved list of such courses.

Major Requirements. A minimum of eight full courses in at least eight course registrations in the biosciences, not including the above prerequisites and corequisites or courses specified not for science majors; two of these courses must include related laboratory experience; one laboratory independent study course may be counted toward the laboratory requirement. The eight courses must include one core course from each of three areas: cell biology and genetics; organism structure and function; and ecology and evolution. These courses are prerequisites to many of the advanced courses in these subject areas. The remaining courses may be elected from among courses numbered 100 or above in biology, or from approved courses in the basic science departments of the School of Medicine, or from approved courses of a basic biological character in related departments. Unless otherwise specified for an area of concentration qualified within the biology major, five of these eight courses must be in biology. The elective courses acceptable for a biology major with an area of concentration (see below) are defined by the requirements for that concentration. At least one of these eight courses must be at the 200 level.

For the B.S. Degree

This is the program in biology for students contemplating a career in biological or biomedical sciences.

Prerequisite. Biology 21L, 22L or equivalent.

Corequisites. Chemistry 11L, 12L, and 151L; Mathematics 31, 32; Physics 51L or 53L and 52L or 54L. Additional corequisites may be required for particular areas of concentration (see below).

Major Requirements. A minimum of eight full courses in at least eight course registrations in the biosciences, not including the above prerequisites and corequisites or courses specified not for science majors; two of these courses must include related laboratory experience; one laboratory independent study course may be counted toward the laboratory requirement. The eight courses must include one core course from each of three areas: cell biology and genetics; organism structure and function; and ecology and evolution. These courses are prerequisites to many of the advanced courses in these subject areas. The remaining courses may be elected from among courses numbered 100 or above in biology, or from approved courses in the basic science departments of the School of Medicine, or from approved courses of a basic biological character in related departments. Unless otherwise specified for an area of concentration qualified within the biology major, five of these eight courses must be in biology. The elective courses acceptable for a biology major with an area of concentration (see below) are defined by the requirements for that concentration. At least one of these eight courses must be at the 200 level.

For Areas of Concentration

Students may elect to complete requirements in specified areas of concentration. Currently available areas of concentration in the biology major are: animal behavior, biochemical engineering, cell and molecular biology, evolutionary biology, genetics, marine biology, neuroscience, and pharmacology. Certification in an area of concentration is designated on the official transcript. For information on areas of concentration see the Director of Undergraduate Studies.

The Negotiated Major

As an alternative to the above programs, a student with unusual interests in biology may arrange a negotiated concentration of study. After appropriate discussion with departmental faculty, a student may devise a program of study which must be endorsed by two members of the faculty and approved by the Director of Undergraduate Studies. The statement of the proposed program must make clear why the negotiated major is more appropriate than a conventional major. Such a program must be arranged before the start of a student's fifth semester. The only formal limitation on this approach to the major is that it include at least five courses in biology to meet minimum Trinity College requirements.

Honors/Distinction

A program for graduation with distinction in biology is available. See the section on honors in this bulletin. The Director of Undergraduate Studies can provide more details.

Botany (BOT)

Professor Searles, *Chair*; Professors Antonovics, Barber, Boynton, Christensen, W. Culberson, Ramus, Reynolds, Schlesinger, Siedow, Stone, Strain, Terborgh, White, and R. Wilbur; Associate Professors Knoerr and Mishler; Assistant Professors Baldwin, Clark, Dong, B. Kohorn, Sun, and Vilgalys; Professors Emeriti Anderson, Billings, Hellmers, Kramer, Naylor, and Philpott; Research Professors C. Culberson and Patterson; Adjunct Professor Osmond; Adjunct Associate Professors Funk, Harris, Kress, Lacey, Wagner, and Zimmer; Lecturers Armaleo and Bush

See Biology for a description of the major and the list of courses taught by the botany faculty.

Canadian Studies Program

Professor Cahow (history), *Director*; Professors Bates (political science), Davis (history), Gillis (public policy and economics), Kornberg (political science), Maddox (sociology), Paletz (political science), Richardson (environment), J. Smith (sociology), Thompson (history), Tiryakian (sociology), Vidmar (law), Warren (community and family medicine), and Wood (history); Associate Professors Hull (Romance studies) and Kimbrough (economics); Assistant Professors Mayer (public policy) and S. Smith (public policy); Professors Emeriti Preston (history) and Tuthill (economic geography); Research Professor Davidson (international studies); Adjunct Professor Steen (environment); Adjunct Associate Professors Keineg (Romance studies) and Wilson (history); Visiting Professor Aharoni (business)

A second major is available in this program.

The program in Canadian studies seeks to provide the student with an understanding of Canada and its problems and prospects. Students may undertake the program to supplement another major, or to complete a second major in Canadian studies, or as part of an interdepartmental concentration, or under Program II. Canadian studies may also be an area concentration in the comparative area studies major, described elsewhere in this bulletin. See sections below on the program and the major. The courses are described in the departmental and interdisciplinary listings.

COURSES WITH CANADIAN CONTENT

The following courses count as one course in the four required for the program in Canadian studies and in the eight required for the major in Canadian studies. Independent studies may also be arranged with Canadian Studies faculty.

Economics

265. International Trade and Finance. *Kimbrough, Krueger, and Tower*

English

179S. Repairing the Continent: Canadian and United States Literary Perspectives. *A. Davidson*

186S, A. Canadian Literature in English. *A. Davidson*

186S, B. Canadian Theater. *Staff*

288. Margaret Atwood. *A. Davidson*

French

131S. French in the New World. *Thomas*

169. The Contemporary Novel in French Canada. *Keinig*

Health Administration

Students interested in this area should consult the director of the Canadian Studies Program.

History

106S. Geography of Canada. *Tuthill*

108C. Canadian-American Relations. *Thompson*

119A. Native American History. *Wood*

121B. The United States as a World Power. *Davis*

166S. American Dreams/American Realities. *Wilson*

167S. United States and Canadian Constitutional Issues. *Cahow*

183S. Canada from the French Settlement. *Cahow or Thompson*

195S.45. Canadian and American Agrarian Movements. *Thompson*

196S.24. Problems in Recent United States Diplomatic History. *Davis*

215S. The United States in International Relations: The Eighteenth and Nineteenth Centuries. *Davis*

216S. United States Diplomacy, 1890-1945. *Davis*

Interdisciplinary Courses

98. Introduction to Canada. C-L: Economics 98, History 98, Political Science 98, and Sociology 98.

Cahow or Thompson

182. Media in Comparative Perspective. C-L: Political Science 182 and Sociology 182. *Paletz or J.*

Smith

184S. Canadian Issues. C-L: Comparative Area Studies, Cultural Anthropology 184S, Economics 184S, History 184S, Political Science 184S, and Sociology 184S. *Cahow or Thompson*

282S. Canada: Research Seminar. C-L: Comparative Area Studies, Cultural Anthropology 282S, History 282S, Political Science 282S, and Sociology 282S. *Cahow or Thompson*

Political Science

117. Comparative Government and Politics. *Staff*

180. Media in Comparative Perspective. *Paletz or J. Smith*

203S. Issues in Politics and the Media in the United States. *Paletz*

266S. Comparative Social Policies. *S. Smith*

277. Comparative Party Politics. *B. Kornberg or Lange*

293. Federalism. *Staff*

Public Policy Studies

265S. The Process of International Negotiation. C-L: Political Science 265S. *Mayer*

Sociology

167. The Social Bases of Politics. *Gereffi or J. Smith*

171. Comparative Health Care Systems. *Maddox*

179. Modern Nationalist Movements. *Tiryakian*

182. Media in Comparative Perspective. *Paletz or J. Smith*

222. The State and Communications Policy. *J. Smith*

255. Political Sociology. *J. Smith or Tiryakian*

THE PROGRAM

In the Canadian Studies Program, a student must take four courses with Canadian content. These must include Interdisciplinary Course 184S (which has the prerequisite of Interdisciplinary Course 98 or consent of instructor). Students who do not have the equivalent of two years of college-level French are strongly encouraged to take French 21 and 22, Intensive French.

THE MAJOR

Prerequisite. Interdisciplinary Course 98.

Corequisite. Completion of another major.

Major Requirements. Eight courses in Canadian studies. These must include Interdisciplinary Course 184S and seven other semester-course credits in courses on Canada, some of which may be fulfilled by independent study or special reading courses. No more than two courses required for the first major may be counted for a Canadian studies major. To complete the major in Canadian studies a student must also take at least two full years of college-level French, or must possess an equivalent competence in the language as certified by the Department of Romance Studies.

For further information, contact the Director, 2016 Campus Drive.

Cell Biology

For courses in cell biology, see Biology and Medicine (School)—Graduate (School) Basic Science Courses Open to Undergraduates.

Chemistry (CHM)

Professor Crumbliss, *Chair*; Professor Bonk, *Director of Undergraduate Studies and Supervisor of Freshman Instruction*; Professors Baldwin, Chesnut, Fraser-Reid, Lochmüller, McGown, McPhail, Palmer, Porter, Shaw, Smith, and Wells; Associate Professors Henkens and Pirrung; Assistant Professors Coury, MacPhail, Polniaszek, Prisant, Toone, and Yang; Professors Emeriti Arnett, Bradsher, Brown, Hobbs, Poirier, Quin, Strobel, and Wilder; Adjunct Professors Ghirardelli and Spielvogel; Adjunct Associate Professor Morosoff; Adjunct Assistant Professor Chao

A major is available in this department.

Courses with laboratories include fifty to sixty hours of laboratory work per term.

11L, 12L. Principles of Chemistry. (NS) The introductory course for students who intend to take additional chemistry courses other than Chemistry 83. 11L: emphasizes stoichiometry and atomic and molecular structures. 12L: emphasizes thermodynamics, chemical kinetics, synthesis, and analysis. Laboratory work includes both qualitative and quantitative analysis. Prerequisites: one year of high school chemistry or consent of instructor; Mathematics 19 or its equivalent; and for 12L: Chemistry 11L. One course each. *Bonk and staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

83. Chemistry and Society. (NS) For students not majoring in a natural science or continuing in chemistry, but wishing to develop a greater appreciation for chemistry as a key for understanding the observable material world and to gain a background for decisions on societal problems resulting from the impact of chemistry on the environment in the late twentieth century. No previous science background is assumed. Not open to students having credit for Chemistry 11L or equivalent. One course. *Staff*

117. Inorganic Chemistry. (NS) Bonding, structures, and reactions of inorganic compounds studied through physical chemical concepts. Prerequisite: Chemistry 161 or 162L. One course. *Crumbliss, Palmer, or Wells*

117L. Inorganic Chemistry. (NS) See Chemistry 117. Includes laboratory. One course. *Crumbliss, Palmer, or Wells*

131. Analytical Chemistry. (NS) Fundamentals of qualitative and quantitative measurement with emphasis on chemometrics, quantitative spectrometry, electrochemical methods, and common separation techniques. Corequisite: Chemistry 133L. Prerequisite: Chemistry 163L. One course. *Coury, Lochmüller, or McGown*

133L. Analytical Chemistry Laboratory. (NS) Laboratory experiments designed to accompany Chemistry 131. Corequisite: Chemistry 131. Half course. *Staff*

151L, 152L. Organic Chemistry. (NS) The structures and reactions of the compounds of carbon. Laboratory: techniques of separation, organic reactions and preparations, and systematic identification of compounds by their spectral and chemical properties. Prerequisite: Chemistry 12L, 23L, or 31S or consent of Director of Undergraduate Studies; for 152L: Chemistry 151L. One course each. *Baldwin, Fraser-Reid, Pirrung, Polniaszek, Porter, or Toone*

154L. Intermediate Organic Chemistry: Mechanism and Stereochemistry of Synthetic Organic Reactions. (NS) A mechanism-based survey of enolate chemistry, sigmatropic rearrangements, polyene cyclizations, hydroboration, oxidation and reduction methods. Laboratory work emphasizes techniques involved in manipulation of sensitive reagents and analysis of reaction products. Prerequisite: Chemistry 152L. One course. *Pirrung or Polniaszek*

161. Physical Chemistry. (NS) Fundamentals of theoretical chemistry with particular emphasis on chemical thermodynamics and kinetics. Chemistry 163L should be taken concurrently. Prerequisites: Chemistry 12L, Mathematics 32, and Physics 52L or 54L. One course. *Chesnut, Henkens, MacPhail, McPhail, Prisant, Smith, or Yang*

162L. Physical Chemistry. (NS) Fundamentals of theoretical chemistry with particular emphasis on quantum chemistry, molecular structure, and molecular spectroscopy. Laboratory. Prerequisite: Chemistry 12L, Physics 52L or 54L, Mathematics 103 or consent of instructor. One course. *Chesnut, Henkens, MacPhail, McPhail, Prisant, Smith, or Yang*

163L. Physical Chemistry Laboratory. (NS) Laboratory experiments designed to accompany Chemistry 161. Prerequisite: (or corequisite) Chemistry 161. Half course. *Staff*

176. Biophysical Chemistry. (NS) The physical chemical principles of and experimental methods employed in the study of biological macromolecules. Students may not receive credit for both Chemistry 176 and 196S. Prerequisite: Chemistry 161 or Biochemistry 227. One course. *Henkens*

191, 192. Independent Study. (NS) Supervised reading and research. Consent of Independent Study Coordinator required. One course each. *Staff*

193, 194. Independent Study. (NS) Supervised reading and research. Prerequisites: Chemistry 191, 192, and consent of Independent Study Coordinator. One course each. *Staff*

195S, 198S. Seminar. (NS) Topics from various areas of chemistry, changing each year. For example: organic chemistry of biologically important compounds, chemical basis of pharmacology, metal ions in biological systems. Open to senior chemistry majors or by consent of instructor. One course each. *Staff*

196S. Seminar. (NS) Selected topics in physical chemistry of biological macromolecules. Students may not receive credit for both Chemistry 176 and 196S. Prerequisites: Chemistry 163L and 175 or Biochemistry 227. One course. *Henkens or Shaw*

For Seniors and Graduates

201. Molecular Spectroscopy. (NS) Selected spectroscopic methods in the study of molecular structure. Symmetry and group theoretical basis for selection rules, theories of magnetic and optical resonance, and interpretation of spectra; examples from both inorganic and organic chemistry. Three lectures. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. One course. *Baldwin, Fraser-Reid, Palmer, Pirrung, Prisant, and Smith*

203. Quantum Chemistry. (NS) Basic principles of quantum and group theoretical methods. Topics include symmetry and a review of the fundamentals and the mathematical foundations of quantum theory. Emphasis on the application of molecular orbital theory to organic and inorganic systems. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. Prerequisite: Chemistry 162L. One course. *Chesnut, MacPhail, Polniaszek, and Porter*

205. Structure and Reaction Dynamics. (NS) Structure and mechanisms in organic and inorganic compounds, substitution reactions, linear free energy relations, and molecular rearrangements. Emphasis on the use of kinetic techniques to solve problems in reaction mechanisms. Three lectures. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. One course. *Crumbliss, Polniaszek, Porter, Toone, and Wells*

207. Principles of Kinetics, Thermodynamics, and Diffraction. (NS) Three lectures. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. One course. *McPhail, Prisant, Smith, and Yang*

209. Advanced Chemistry. (NS) A combination of three one-third course segments from Chemistry 201, 203, 205, and 207. Interested students should consult the Director of Undergraduate Studies for scheduling. Consent of Director of Undergraduate Studies required. One course. *Staff*

275, 276. Advanced Studies. (NS) (1) Analytical chemistry, (2) inorganic chemistry, (3) organic chemistry, and (4) physical chemistry. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. One course each. *Staff*

COURSES CURRENTLY UNSCHEDULED

23L. Advanced General Chemistry. (NS)

31S. Advanced Chemical Fundamentals. (NS)

151M, 152M. Organic Chemistry. (NS)

152P. Preceptorial. (NS)

175. Molecular Basis of Biological Processes. (NS)

197S. Seminar. (NS)

THE MAJOR

Differing major programs are offered under the baccalaureate degrees, including a new concentration in the area of biochemistry. The Bachelor of Arts degree programs permit greater flexibility in allowing students to select an area of concentration while satisfying the junior-senior small group learning experience requirements through seminar courses (option one) or through independent study in chemistry or related departments (option two). Of particular significance are the areas of emphasis (option three) including biology, mathematics, physics, materials science, and chemical engi-

neering. The Bachelor of Science degree program, accredited by the American Chemical Society, provides in-depth preparation for graduate study in chemistry.

For the A.B. Degree

Prerequisites. Chemistry 11L, 12L; or Chemistry 23L or 31S; or advanced placement. Mathematics 31, 32 (or 31L, 32L or 33, 34); Physics 51L, 52L (or 53L, 54L).

Major Requirements. Chemistry 131, 133L, 151L, 152L, and either 162L or 161 and 163L, plus one of the following options:

1. Two of the following: Chemistry 117 or 117L, 154L, 162L, 175 (or Biochemistry 227), 176, 195S, 196S, 198S.
2. One of the following: Chemistry 117 or 117L, 154L, 162L, 175 or Biochemistry 227; plus Chemistry 191, 192 or the equivalent in a natural science, mathematics, engineering, or a basic science department in the School of Medicine.
3. One of the following:
 - a. Physics emphasis. Chemistry 162L plus two of the following: Physics 143L, Physics 181, Physics 182.
 - b. Mathematics emphasis. Chemistry 162L plus two of the following: Mathematics 104, Mathematics 111, Mathematics 114.
 - c. Biology emphasis. Biochemistry 227 plus two of the following: Biology 151, Biology 152, Biology 160, Biology 184L, Biology 244.
 - d. Materials Science emphasis. One of the following: Chemistry 117 or 117L; 154L, 162L, Biochemistry 227; plus Engineering 83; plus one of the following: Engineering 101, Mechanical Engineering 113, Mechanical Engineering 208.
 - e. Chemical Engineering emphasis. One of the following: Chemistry 117 or 117L; 154L, 162L, Biochemistry 227; plus Engineering 75; plus one of the following: Engineering 123, Mechanical Engineering 126.

In certain cases, substitutions may be made for courses outside the chemistry department with consent of the Director of Undergraduate Studies.

Recommendations. Computer Science 53 or Engineering 51, Mathematics 103 (for options one and two), and Chemistry 162L. Students planning graduate study are advised to take these recommended courses and to consult with advisors regarding appropriate additional courses.

For the B.S. Degree

Prerequisites. Chemistry 11L, 12L; or Chemistry 23L or 31S; or advanced placement. Mathematics 31, 32 (or 31L, 32L or 41); 103; and Physics 51L, 52L (or 53L, 54L).

Major Requirements. Chemistry 117L, 131, 133L, 151L, 152L, 161, 162L, 163L, plus three or four additional courses selected according to option 1, 2, or 3.

1. Three chemistry courses selected as follows.

At least 2 of the following: Chemistry 154L, 191 or 192.
Plus: Chemistry 176, 195S, 196S, 198S, 201, 203, 205, 207, 209, 275 or 276.
2. Two chemistry courses plus one approved course in another department selected as follows.

At least 1 of the following: Chemistry 154L, 191 or 192.
Plus: Chemistry 176, 195S, 196S, 198S, 201, 203, 205, 207, 209, 275 or 276.
Plus: One lecture course in an approved science department in Trinity College, basic science of the School of Medicine, or in the School of Engineering.
3. Two chemistry courses plus two independent study courses in an approved department selected as follows.

At least two of the following: Chemistry 154L, 176, 191, 195S, 196S, 198S, 201, 203, 205, 207, 209, 275 or 276.

Plus: Two approved independent study courses in a science department in Trinity College, basic sciences of the School of Medicine, or in the School of Engineering.

Chemistry 201, 203, 205, and 207 are offered also in one-third semester segments; in some instances a student may wish to take some combination of three of these segments by registering for Chemistry 209. Additional details may be obtained from the Director of Undergraduate Studies.

Recommendations. Mathematics 104 and Physics 100. Students planning graduate study in chemistry should consult with advisors regarding appropriate additional courses.

The Concentration in Biochemistry

In cooperation with the Department of Biochemistry in the School of Medicine, the Chemistry Department offers both an A.B. and a B.S. degree in chemistry with concentration in biochemistry. Certification of this concentration is designated on the official transcript.

For the A.B. Degree with Concentration in Biochemistry

Prerequisites: Chemistry 11L, 12L (or 23L or 31S or advanced placement); Mathematics 31, 32 (or 31L, 32L or 41); Physics 51L, 52L (or 53L, 54L); and Biology 21L, 22L.

Major Requirements. Chemistry 131/133L, 151L, 152L, 161/163L; Biochemistry 227, 228; *plus* one of the following: Chemistry 176, 191, 195S, 198S; Biology 160, 180, 184L, 191; or any advanced course in biochemistry.

For the B.S. Degree with Concentration in Biochemistry

Prerequisites. Chemistry 11L, 12L (or 23L or 31S or advanced placement); Mathematics 31, 32 (or 31L, 32L or 41); Physics 51L, 52L (or 53L, 54L); and Biology 21L, 22L.

Major Requirements. Chemistry 117L, 131/133L, 151L, 152L, 161/163L, either 176 or 162L; Biochemistry 227, 228; Biology 160 or 180, *plus* one of the following: Chemistry 191, Biology 191, or Biochemistry 209.

Recommendations. Chemistry 192, 195S, 198S; Biology 184L, 192; advanced courses in biochemistry.

Honors/Distinction

The department offers a program for graduation with distinction in chemistry. See the section on honors in this bulletin. The program involves two semesters of independent study, taken either in the chemistry department (Chemistry 191, 192) or, with the prior approval of the Coordinator of Independent Study, in an appropriate science department in Trinity College, the School of Engineering, or the School of Medicine. A research paper based upon the independent study and nomination by the research supervisor form the basis for consideration by a departmental committee. The committee may recommend the student for graduation with distinction in chemistry. The department also offers Latin honors by honors project. Additional details may be obtained from the Director of Undergraduate Studies.

Chinese

For courses in Chinese, see Asian and African Languages and Literature.

Classical Studies (CS)

Associate Professor Rigsby, *Chair*; Professor Younger, *Director of Undergraduate Studies*; Professors Clay, Connor, Newton, and Oates; Associate Professors Boatwright, Burian, and Stanley; Assistant Professor Janan; Professors Emeriti Richardson and Willis; Senior Lecturing Fellow Zarker

Majors are available in this department.

The objective of classical studies is to increase knowledge and understanding of the roots of Western culture in the civilizations of Greece and Rome. Toward this aim, the department offers courses in three areas (Latin, Greek, and classical studies) and two majors (classical studies, classical languages). Concentration in the languages offers students training in exploring at first hand the literature, history, and thought of antiquity. In the process, students will gain a deeper insight into language itself, as well as an appreciation of the problems of interpretation and the varieties of evidence upon which interpretation may be based. For students interested in history, ancient art, or archaeology, courses in classical studies offer a means of assessing the culture and the material remains of Greece and Rome in their own rich and varied context.

A secondary aim is, and has been by a centuries-old tradition, the development of a keener perception and understanding of the cultural forces at work in the contemporary world. As a result, the field of classical studies is an excellent foundation for advanced work in other academic disciplines as well as in professional programs in law, medicine, and finance.

GREEK (GRK)

1-2. Elementary Greek. (FL) A study of grammar and an introduction to reading. Two courses. *Staff*

14S. Intensive Elementary Greek. (FL) Introduction to the grammar, offered only in the summer; combining the work of Greek 1 and 2 in one course. Two courses. *Staff*

15S. Intensive Intermediate Greek. (FL) Combining the work of Greek 63 and 64 in one course, offered only in the summer; selected readings in prose and poetry. Two courses. *Staff*

63, 64. Intermediate Greek. (FL) Introduction to Greek prose and poetry. 63: Plato's *Republic*, *Apology*, or *Symposium*. 64: Euripides and Homer. One course each. *Burian or Clay*

103S, 104S. Studies in Greek Literature. (AL, FL) 103S: Herodotus and Sophocles. 104S: Thucydides and Aristophanes. One course each. *Burian, Clay, or Oates*

200. Readings in Greek Literature. (AL, FL) One course. *Staff*

205. Greek Lyric Poets. (AL, FL) Fragments of the early lyric poets; selected odes of Pindar and Bacchylides. One course. *Burian or Stanley*

207. The Dramatists. (AL, FL) Readings and studies of selected plays by the major playwrights Aeschylus, Sophocles, Euripides, and Aristophanes. One course. *Burian*

209. Introduction to Hellenistic Literature. (AL, FL) Readings in selected texts of the period from Alexander to Augustus, including historical narratives, documents, philosophical and scholarly treatises, drama, and poetry. One course. *Rigsby*

210. Alexandrian Poetry. (AL, FL) Emphasis on the *Argonautica* of Apollonius of Rhodes, and attention to the shorter poems of Theocritus and Callimachus. One course. *Stanley*

226. The Orators. (AL, FL) Selections from the principal Attic orators, with emphasis on Lysias and Demosthenes. One course. *Connor*

Courses offered each year on demand in consultation with the Director of Undergraduate Studies:

191, 192. Independent Study. Directed reading and research. Open only to qualified juniors and seniors. One course each. *Staff*

193, 194. Honors Research in Greek. Research culminating in the writing of one longer or two shorter papers as partial fulfillment of the requirements for graduation with distinction. Open only to senior majors. One course each. *Staff*

217T. Greek Prose Composition. (FL) The course content is determined by the needs of the students enrolled. One course. *Staff*

Courses Currently Unscheduled

203. Homer. (AL, FL)

222. The Historians. (AL, FL)

LATIN (LAT)

1-2. Elementary Latin. (FL) Study of the structure of the language (forms, vocabulary, syntax, and pronunciation); selected readings in prose and poetry. Two courses. *Stanley*

14S. Intensive Elementary Latin. (FL) Introduction to the grammar, offered only in the summer; combining the work of Latin 1 and 2 in one course. Two courses. *Staff*

15S. Intensive Intermediate Latin. (FL) Combining the work of Latin 63 and 64 in one course, offered only in the summer; selected readings in prose and poetry. Two courses. *Staff*

63, 64. Intermediate Latin. (FL) Introduction to Latin prose and poetry. 63: selected prose, including Caesar. 64: three books of Vergil's *Aeneid*. One course each. *Rigsby or Zarker*

100. Introduction to Literature. This number represents course credit for a score of 4 or 5 on one or more of the College Board Advanced Placement tests in Latin. One course.

103S, 104S. Studies in Latin Literature. (AL, FL) 103S: the Late Republic, including Catullus and Cicero. 104S: the Age of Augustus, including Horace and Livy. One course each. *Janan or Stanley*

105S. Ovid: *The Metamorphoses*. (AL, FL) The poem studied as representative of Ovid's varied narrative art, as the largest-scale Roman treatment of classical myths, and as Ovid's statement on Augustanism. One course. *Janan or Newton*

106S. Roman Satire. (AL, FL) A survey of the genre with concentration on Horace and Juvenal. One course. *Staff*

107S. Vergil's *Aeneid*. (AL, FL) Reading and analysis of the *Aeneid*, with particular attention to stylistics and historical setting. One course. *Newton*

108S. Lyric and Occasional Poetry. (AL, FL) Readings in the works of Catullus, Horace, and Martial. One course. *Janan or Newton*

111S. Elegiac Poets. (AL, FL) The traditions of Latin love elegy and its development in Propertius, Tibullus, and Ovid. One course. *Janan*

112S. Roman Comedy. (AL, FL) Representative plays of Plautus and Terence with lectures on the genre and its Greek forebears. One course. *Richardson*

116S. Lucretius. (AL, FL) The *De Rerum Natura* studied as poetry and philosophical thought. One course. *Clay or Newton*

170. Special Topics in Latin Literature. (AL, FL) Prerequisite: Latin 64 or 104S, depending on the topic. One course. *Staff*

200. Readings in Latin Literature. (AL, FL) One course. *Staff*

205. The Roman Novel. (AL, FL) Readings in Petronius and Apuleius. One course. *Richardson*

206S. Cicero. (AL, FL) One course. *Richardson*

208S. Lyric and Occasional Poetry. (AL, FL) Readings in the works of Catullus, Horace, and Martial. Same as 108S, except additional term paper required. One course. *Janan or Newton*

211S. Elegiac Poets. (AL, FL) Analysis of most of the *corpora* of Propertius, Tibullus, and Ovid with close attention to the stylistics of the poems, their place in the traditions of Latin love elegy, and their relation to other phenomena of the Augustan period. Not open to students who have taken Latin 111S. One course. *Richardson*

214S. The Historians. (AL, FL) Investigations of the Romans' conceptions and practices of writing history, based on detailed analysis of the works of Sallust, Livy, and Tacitus. Additional readings in the fragments of other Latin historians, and in comparative Greek historians. Not open to students who have taken Latin 114S. One course. *Boatwright or Richardson*

221. Medieval Latin. (AL, FL) Selected works of the Latin Middle Ages from Prudentius to the humanists. Genres studied usually include the hymn, sequence, drama, lyric, saints' lives, chronicle, epic, and epistle. C-L: Medieval and Renaissance Studies. One course. *Newton*

Courses offered each year on demand in consultation with the Director of Undergraduate Studies.

191, 192. Independent Study. Directed reading and research. Open to qualified juniors and seniors. One course each. *Staff*

193, 194. Honors Research in Latin. Research culminating in the writing of one longer or two shorter papers as partial fulfillment of the requirements for graduation with distinction. Open only to senior majors. One course each. *Staff*

217T. Latin Prose Composition. (FL) The course content is determined by the needs of the students enrolled. One course. *Staff*

Courses Currently Unscheduled

204. Epic of the Silver Age. (AL, FL)

207S. Vergil's *Aeneid*. (AL, FL)

CLASSICAL STUDIES (CS)

11S. Greek Civilization. (CZ) The culture of the ancient Greeks from the Bronze Age to Alexander the Great: art, literature, history, philosophy, and religion. One course. *Staff*

12S. Roman Civilization. (CZ) The culture of ancient Romans from their beginnings to Constantine: art, literature, history, philosophy, and religion. One course. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

53. Greek History. (CZ) The political and intellectual history of the Hellenes from earliest times to the death of Alexander the Great. C-L: History 53. One course. *Oates*

54. Roman History. (CZ) The Roman Republic and Empire to the Late Antique. C-L: History 54. One course. *Oates*

63. The Epic. (AL) Reading in translation of major epics from antiquity and the Middle Ages, such as *Gilgamesh*, Homer's *Iliad* and *Odyssey*, Vergil's *Aeneid*, and *Beowulf*. One course. *Burian or Clay*

64. Drama of Greece and Rome. (AL) Reading in translation of Greek and Roman tragedies (Aeschylus, Sophocles, Euripides, Seneca) and comedies (Aristophanes, Menander, Plautus, Terence). C-L: Drama 64. One course. *Burian*

70. The Age of Augustus. (CZ) Augustus (63 B.C.-A.D. 14), the person, politician, and genius of a new age. His impact on contemporary historical, biographical, and literary writings, and on the architecture of his new empire, its coinage, and his own portraiture. C-L: History 94. One course. *Zarker*

93. History of Ancient Philosophy. (CZ) Prerequisites: for first-year students, previous philosophy course and consent of instructor. See C-L: Philosophy 93. One course. *Ferejohn or Mahoney*

95. Principles of Archaeology. (CZ) Introduction to the many disciplines of archaeology, including a history of the subject, excavation techniques, surveying, creating stylistic typologies, mechanical drawing, and the interpretation of archaeological evidence. One course. *Younger*

99. Perspectives in Archaeology. (CZ) See C-L: Religion 99; also C-L: Interdisciplinary Course 99 and Judaic Studies. One course. *C. Meyers, E. Meyers, Younger, and staff*

102. History of Greek and Roman Civil Law. (CZ) The development of law from the early Greek *polis* and Rome of the XII Tables to the *Digest* of Justinian, emphasizing civil law and procedure. C-L: History 182C. One course. *Oates*

104S. Women in the Ancient World. (CZ) The perception and reality of the roles, functions, and status of women from the time of Homer to late antiquity. C-L: History 126S and Women's Studies. One course. *Boatwright*

113. Aristotle. (CZ) See C-L: Philosophy 123. One course. *Ferejohn*

117. Ancient Myth in Literature. (AL) Myth in classical and medieval writers from Hesiod to Boccaccio. C-L: Medieval and Renaissance Studies. One course. *Newton*

121. The Art of Ancient Italy. (AL) See C-L: Art 121. One course. *Staff*

122. Art and Myth in Ancient Greece. (AL) See C-L: Art 122. One course. *Staff*

123. Greek Art and Archaeology I. (AL) Greek architecture, sculpture, and painting from the Bronze Age through the Classical period. C-L: Art 123. One course. *Younger*

124. Greek Art and Archaeology II. (AL) Architecture, sculpture, painting, and mosaics from the Classical period through the Greco-Roman period. C-L: Art 124. One course. *Younger*

125. The City in Antiquity. (CZ) See C-L: Art 125. One course. *Staff*

128. Art of the Roman Empire. (AL) See C-L: Art 128. One course. *Staff*

130. Late Antique Christian Art. (AL) See C-L: Art 130; also C-L: Religion 130. One course. *Wharton*

131. Art of the Early Middle Ages. (AL) See C-L: Art 131; also C-L: Medieval and Renaissance Studies. One course. *Bruzellius or Wharton*

135. Alexander the Great. (CZ) His career and the effects of his conquests. C-L: History 181. One course. *Oates*

139. Aspects of Medieval Culture. (CZ) See C-L: Medieval and Renaissance Studies 114; also C-L: Art 139 and History 116. One course. *Bruzeliuss, Solterer, and Witt*

145. Rome: History of the City. (CZ) The development of the urban plan and its major monuments through the ages; the influence of the ancient Republic and Empire, the Papacy, and the modern secular state; change and continuity in artistic forms and daily life. (Taught on site in Italy in summer.) C-L: Art 126. One course. *Staff*

147. Ancient Greece. (CZ) On-site study of the cultures in Greece from Neolithic to Medieval, concentrating on Athens, the Peloponnese, Crete, and the Cyclades. Summer program in Greece. Prerequisite: Classical Studies 115, 53, 123, or 124, or History 53, or consent of instructor. C-L: Art 115. One course. *Younger*

155. The Aegean Bronze Age. (CZ) Application of archaeological techniques and procedures to problems in the development of the Minoan and Mycenaean civilizations. C-L: Art 114. One course. *Younger*

162. Pompeii. (CZ) Contributions of the city to knowledge of ancient Roman life: its history, houses and temples, amusements, and municipal administration. C-L: Art 117. One course. *Richardson*

173. Classical Political Philosophy. (CZ) Ancient theories of the way of life and the political regime best suited to promote happiness in human communities. Readings from the Greek sophists, Aristophanes, Plato, Aristotle, the academic skeptics, Stoics, and Cicero. Prerequisite: junior standing; open to sophomores by consent of instructor. C-L: Philosophy 173 and Political Science 182. One course. *Staff*

195S, 196S. Junior-Senior Seminars in Classical Studies. (CZ) Specific aspects of the history, art, and literature of classical Greece and Rome. Open only to qualified juniors and seniors; some knowledge of classical studies and history desirable, but not strictly necessary. One course each. *Staff*

211S. Plato. (CZ) Selected dialogues. C-L: Philosophy 211S. One course. *Ferejohn*

217S. Aristotle. (CZ) Selected topics. C-L: Philosophy 217S. One course. *Ferejohn*

220S. Topics in Greek Art. (AL) Consent of instructor required. See C-L: Art 201S. One course. *Staff*

221. Archaic Greece. (CZ) Greece and the Near East from the end of the Bronze Age to the Persian Wars. C-L: History 259. One course. *Oates or Rigsby*

222. Fifth and Fourth Century Greece. (CZ) From the Persian Wars to the dominance of Philip of Macedon. C-L: History 260. One course. *Oates or Rigsby*

223. Alexander and the Hellenistic World. (CZ) The achievements and legacy of Alexander the Great and the rise of Roman power in the Eastern Mediterranean. C-L: History 261. One course. *Oates*

224. The Roman Republic. (CZ) The rise of Rome, to its mastery of the Mediterranean; the political, social, and intellectual consequences. C-L: History 263. One course. *Boatwright or Rigsby*

225. The Roman Empire. (CZ) The foundation, consolidation, and transformation of Roman rule from Augustus to Diocletian. C-L: History 264. One course. *Boatwright*

227S. Topics in Roman Art. (AL) Consent of instructor required. See C-L: Art 202S. One course. *Staff*

230S. Topics in Early Christian and Byzantine Art. (AL) Consent of instructor required. See C-L: Art 233S; also C-L: Medieval and Renaissance Studies and Religion 275S. One course. *Wharton*

231S. Greek Sculpture. (AL) Free standing, relief, and architectural sculpture from the archaic period to the Hellenistic age, representing changing aesthetic, social, and political aims. C-L: Art 238S. One course. *Younger*

232S. Greek Painting. (AL) From the Late Bronze Age to the fourth century B.C., with emphasis on archaic and classical Athenian vase painters. C-L: Art 237S. One course. *Stanley*

233S. Greek Architecture. (AL) Development of form and function in the various religious, civic, and domestic building types, from the Bronze Age through the Hellenistic period. C-L: Art 205S. One course. *Richardson or Younger*

236S. Roman Painting. (AL) The techniques, iconography, and use in decoration. C-L: Art 227S. One course. *Richardson*

258. The Hellenistic and Roman East. (CZ) The social and cultural history of the Greco-Roman world, concentrating on papyrological evidence. Prerequisites: knowledge of ancient Greek and Latin. One course. *Oates*

Courses offered each year on demand in consultation with the Director of Undergraduate Studies.

191, 192. Independent Study. Directed reading and research. Open only to qualified juniors and seniors. One course each. *Staff*

193, 194. Honors Research in Classical Studies. Research culminating in the writing of one longer or two shorter papers as partial fulfillment of the requirements for graduation with distinction. Open only to senior majors. One course each. *Staff*

Courses Currently Unscheduled

101. Science and Technology in the Ancient World. (CZ)

103. Religion in Greece and Rome. (CZ)

114D. Hellenistic Philosophy. (CZ)

115. The Classical Tradition. (AL)

129. The Age of Justinian. (AL)

137-138. Roman and Non-Roman in Ancient Italy. (CZ)

161S. Athens. (CZ)

171. Ancient Cosmology. (CZ)

226. Late Antiquity. (CZ)

235S. Roman Architecture. (AL)

THE MAJOR

Students may choose first or second majors in classical studies (ancient history, archaeology, literature in translation or in the original) or in classical languages (a third-year reading level in either Latin or Greek and a second-year reading level in the other ancient language, with additional course work in classical civilization).

Students who contemplate graduate work in classical studies or in the ancient languages Greek and Latin are reminded of the necessity for competence in both these

languages (usually at least three years of the one and two of the other) and an eventual reading knowledge of French and German for all higher degrees.

Prospective majors in classical languages are urged to consult with the Director of Undergraduate Studies at the earliest feasible time, preferably by the sophomore year.

Majors are eligible for nomination to one semester during their junior year at the Intercollegiate Center for Classical Studies in Rome, of which Duke University is a founding member, or at the College Year in Athens, at a cost comparable to that of a semester at Duke. Financial assistance at Duke can usually be transferred, and arrangements are made through the University. Courses in Greek, Latin, ancient history, and archaeology taken in these programs are counted toward the major requirements. For further information, see the section on study abroad.

Classical Studies (Literature, Ancient History, Civilization, or Archaeology)

Prerequisites. Classical Studies 11S or 53, and Classical Studies 12S or 54.

Major Requirements. Seven classical studies courses above the level of Classical Studies 60, including Classical Studies 195S or 196S; at least two courses must be in separate areas (literature in translation or above the level of Greek/Latin 64; history, or art and archaeology).

Related Work. The department urges all classical studies majors to fulfill the university foreign language area of knowledge.

Classical Languages (Greek and Latin)

Major Requirements. Both ancient languages, Greek and Latin, one to a full third-year reading level (the equivalent of Greek or Latin 104), and at least four college courses in the other (at least the equivalent of Greek or Latin 64). And two classical studies courses, including Classical Studies 195S or 196S, in separate areas (literature in translation; history, or art and archaeology).

Related Work. The department urges all classical languages majors to acquire some reading knowledge of French and German.

Honors/Distinction

The department offers work leading to graduation with distinction and to graduation with Latin honors by honors project. See the section on honors in this bulletin and the departmental Director of Undergraduate Studies.

Comparative Area Studies Program (CST)

Professor Lawrence, *Director*

A major is available in this program.

The undergraduate major in comparative area studies offers a Bachelor of Arts degree to students interested in the interdisciplinary study of societies and cultures of a particular region of the world. Students complement their study with either a concentration in a second world area or in the comparative study of international problems. The major allows a student to combine language study with courses in a variety of disciplines. As in area studies programs elsewhere, the result is a sustained focus on a single world area tailored to fit the student's interest. Comparative area studies at Duke, however, is distinct from most such programs in several respects. The primary concentration encourages study of language, literature, religion, and art of the chosen area as well as analysis of its social, historical, and political roots and problems. The secondary concentration imparts breadth of focus and a global perspective to the course of study. And the required course on comparative methods focuses attention on the particular disciplinary concerns and approaches of the social sciences and humanities.

Students in the program are currently studying Latin America, the Caribbean, Canada, Africa, the Middle East, Russia, South Asia, East Asia, and Eastern and Western Europe. Many comparative area studies majors double-major in comparative area studies and in such fields as anthropology, history, political science, Spanish, and French. Although the program provides all students with a solid background in liberal arts, it is specifically designed for those with career objectives in academia, government (including the Foreign Service), international business, journalism, international law, public health and environmental organizations, international agencies (both the United Nations and other multilateral agencies), as well as private international religious or service organizations.

The major draws its offerings from courses taught by over 130 Duke professors in fourteen cooperating departments. Interdisciplinary and intercultural courses have been designed specifically for majors in the program to help place those societies chosen for specialization in a broad comparative and global perspective. These courses stress the interrelationship of developed and underdeveloped societies and probe the difficulties and advantages of comparative, interdisciplinary, and intercultural research. The program is administered by its director and an advisory committee representing the various areas and cooperating departments.

Advising: Students must identify the area of their primary concentration. Faculty members with expertise in each area are available to provide advice concerning selection of an area and appropriate course work in the major. Students wishing to specialize in an area not indicated in the categories of courses that follow will be required to submit a proposed course of study to the advisory committee for approval. Selection of area is normally done by the end of the sophomore year. The program encourages close relationships between faculty and students working in similar areas.

Study Abroad or on Another Campus: The program encourages qualified and interested students to engage in sustained study abroad in their chosen area for a summer, a semester, or an academic year. Up to three courses taken in a non-Duke semester abroad program (or one course in a two-course non-Duke summer program) may be counted toward the requirements of the major if they qualify as area or comparative/global issue courses within the major. Students should consult the program director prior to enrollment in the program. Duke students are eligible for a variety of programs now operating in Africa, Asia, Canada, Latin America, Russia, and Eastern and Western Europe. Students can also take advantage of special programs in the United States for intensive language training, legislative or foreign service study in Washington, and internship programs with international agencies. Occasionally summer internships are available for qualified students.

Grants and Awards: At the initiative of the Center for International Studies, a program of grants and awards for majors has been instituted. A competition is held in the fall to select a small group of senior majors to organize a scholarly symposium upon a comparative/global issue held in the spring semester. Summer stipends for travel and research abroad are offered to selected rising senior majors planning to enroll in the honors seminar. The author of the best research paper submitted to the honors seminar is recognized by an award for excellence in comparative analysis.

The courses listed on the following pages meet requirements for the major as introductory courses, area courses, and comparative/global issue courses. Basic language courses and language courses at the 100 and 200 level taught in the foreign language satisfy the foreign language corequisite; such courses are not listed. Only advanced language and literature courses meeting requirements for specific areas of the major are listed below. Selected non-listed upper level and seminar courses offered by various departments and programs (including Comparative Area Studies 140 and Comparative Area Studies 200S), the topics of which vary from semester to semester, may also be included if the topics covered fall within a particular area or focus upon comparative/global issues; to determine if specific courses meet requirements for the

major, consult the director. To meet the general studies requirement of Program I, courses in the major from only two areas of knowledge may be counted. For a complete description of each course, including cross-listings, consult the listing in the Duke University Bulletin under the appropriate department or under Interdisciplinary Courses.

COMPARATIVE AREA STUDIES COURSES

109. Contemporary Global Issues. (SS) Nature of important global phenomena and conditions and their manifestations in diverse regions and societies. Includes such questions as what is progress? Are nation-states obsolete? How are we managing an interdependent world economy and a fragile global environment? C-L: Cultural Anthropology 109, History 109, Political Science 160, and Sociology 175. One course. *Staff*

110. Global Human Geography. (SS) World development and modernization through the lenses of geography. Patterns of adaptation by peoples and societies to different physical environments and the changing world economy. One course. *Staff*

125. Strategies of Comparative Analysis. (SS) Comparative research and analysis in the social sciences and the humanities: strengths and weaknesses of cross-cultural comparison as developed by sociologists, historians, political scientists, anthropologists, and specialists in comparative literature and religion. C-L: Cultural Anthropology 125, History 137, Political Science 125, Religion 121, and Sociology 125. One course. *Staff*

140. Selected Topics in Comparative Area Studies. Topics vary from semester to semester, focusing either on specific world regions or particular comparative/global issues. One course. *Staff*

150S. Comparative Area Studies Honors Seminar. (CZ) Open to seniors majoring in Comparative Area Studies. Consent of instructor required. One course. *Staff*

200S. Advanced Topics in Comparative Area Studies. Topics vary, focusing either on specific world regions or particular comparative/global issues. One course. *Staff*

INTRODUCTORY COURSES

Comparative Area Studies 109. Contemporary Global Issues. *Staff*
Comparative Area Studies 110. Global Human Geography. *Staff*
Cultural Anthropology 94. Introduction to Cultural Anthropology. *Staff*
History 75, 76. The Third World and the West. *Ewald, Gordon, or Little*
Literature 30. Special Topics in National Cinema. *Staff*
Literature 101. Introduction to the Study of Literature and Society. *Willis*
Music 136S. Introduction to Non-Western Music. *Seebass*
Political Science 92. Comparative Politics. *Staff*
Religion 57. Introduction to the Religions of Asia. *Corless, Lawrence, or Partin*
Sociology 110. Comparative Sociology. *Gereffi, Janoski, Myers, Smith, or Tiryakian*

COMPARATIVE/GLOBAL ISSUES COURSES

Art and Art History

168. Art since 1945. *Cernuschi or Stiles*
177. The History of Conceptual Art. *Stiles*
179. The History of Performance Art. *Stiles*
244S. International Expressionism. *Cernuschi and Rolleston*

Asian and African Languages and Literature

121. Topics in Asian and African Literature. *Staff*
131. Introduction to Asian and African Linguistics. *Kaplan or Zhang*

Cultural Anthropology

100. Foundations of Cultural Anthropology. *Staff*
114. Gender Inequality. *Quinn or Starn*
116. Language, Ethnicity, and New Nations. *Staff*
119. Language, Culture, and Society. *Apte, O'Barr, or Strauss*
257S. Food in Cross-Cultural Perspectives. *Apte*

Economics

- 140. Comparative Economic Systems. *Naylor*
- 219S. Economic Problems of Underdeveloped Areas. *Kelley, Krueger, or Naylor*
- 240. Comparative Economic Systems and Change. *Trem*
- 286S. Economic Policy-Making in Developing Countries. *Conrad, Gillis, or Ramachandran*

History

- 101C. Terrorism, 1848-1968. *M. Miller*
- 112A. The World in the Twentieth Century, 1900-1945. *Cell*
- 112B. The World in the Twentieth Century, 1945 to the Present. *Cell*
- 114B. Immigration, Migration, and Mobility of Labor. *Keyssar*
- 120. History of Socialism and Communism. *Lerner*
- 123S. Madness and Society in Historical Perspective. *M. Miller*
- 128. Comparative Social Movements. *Goodwyn*
- 132. Modern World Environmental History, 1500 to the Present. *Richards*
- 158. New Perspectives on the Atlantic World. *Ewald*
- 167S. United States and Canadian Constitutional Issues. *Cahow*
- 168S. The Atlantic Slave Trade. *Gaspar*
- 195S. 18. The Destruction and Aftermath of Slavery in the Americas: A Comparative Perspective.

J. Scott

- 195S.36. State Formation in Global Perspective: The Impact on Women and Families. *Y. Miller*
- 195S.40. Fugitive Slave (Maroon) Communities in New World Slave Societies. *Gaspar*
- 195S.45. Canadian and American Agrarian Movements. *Thompson*
- 218S. Perspectives on the Atlantic World. *Ewald*
- 225S. Problems in Comparative Labor History. *Gordon, Keyssar, or Reddy*
- 233S. Slave Resistance and Social Control in New World Societies. *Gaspar*
- 239S. History of Socialism and Communism. *Lerner*
- 243, 244. Marxism and Society. *Dirlik*

Interdisciplinary Courses

- 120A. Perspectives on Food and Hunger. *Johns*
- 120B. Perspectives on Food and Hunger. *Johns*

Literature

- 135. National Identity. *Farrell, Hell, Kaplan, and Stewart*
- 136. Autobiography across Cultures. *Kaplan and Willis*
- 152. Regional Literatures of the Western World. *Staff*
- 155. Comparative Perspectives on Literature and Social Change: From Plantation to City. *Willis*
- 185. Psychoanalysis, Literature, and Film. *Gaines*
- 198. Censorship, Law, and Literature. *Patterson*

Political Science

- 100K.01. Anglo-American Constitutionalism, Law, and Legal Institutions. (Taught in England.)

Staff

- 100L.01. Law and Liability: Personal Injury in Britain and the United States. (Taught in England.)

Staff

- 107. Comparative Environmental Policies. *McKean*
- 147. International Environmental Politics and Policies. *McKean or Miranda*
- 153. Politics and Media of Mass Communication. *Paletz*
- 155. The Politics and Economics of Developing Areas. *Bates*
- 163. Gender, Politics, and Policy: The Third World Case. *O'Barr*
- 173S. Political Economy of World Food Problems. *Johns*
- 212S. Domestic Structures and Foreign Policies of Advanced Democratic States. *Grieco*
- 231S. Crisis, Choice, and Change in Advanced Democratic States. *Kitschelt*
- 234S. Political Economy of Development: Theories of Change in the Third World. *Staff*
- 235S. Comparative Development of Islam. *Staff*
- 237S. Comparative Public Policy. *Kitschelt*
- 259S. Low Intensity Conflict and the Lessons of Vietnam. *Lomperis*
- 262S. International Communism. *Hough*
- 277. Comparative Party Politics. *Kornberg or Lange*
- 279S. Political Protest and Collective Mobilization. *Kitschelt*
- 293. Federalism. *Staff*

Public Policy Studies

- 179S. Refugees and World Politics. *Boothby*
- 264S.57. Technology and Development. *Ramachandran*
- 266S. Comparative Social Policy. *Smith*
- 284S. Public Policy Process in Developing Countries. *Ascher*
- 286S. Economic Policy-Making in Developing Countries. *Conrad or Gillis*

Religion

- 103. Islam on the Pacific Rim. *Cornell*
- 143. Mysticism. *Staff*
- 157. Bioethics in Comparative Contexts. *McCollough*
- 283. Islam and Modernism. *Lawrence*

Sociology

- 118. Sex, Gender, and Society. *O'Rand*
- 126. Third World Development. *Gereffi*
- 142. Organizations and Global Competitiveness. *Gereffi*
- 143. Management and Labor Relations. *Janoski*
- 170. Mass Communication. *Smith*
- 171. Comparative Health Care Systems. *Maddox*
- 173. Social Conflict and Social Movements. *Tiryakian or Wilson*
- 179. Modern Nationalist Movements. *Tiryakian*
- 182. Media in Comparative Perspective. *Paletz or Smith*
- 214. Comparative and Historical Methods. *Archer, Gereffi, Janoski, Lin, Smith, or Tiryakian*
- 222B. Comparative Aspects of Societal Transformation. *Gereffi, Lin, Simpson, Smith, or Tiryakian*
- 222D. Special Topics in Historical and Comparative Sociology. *Gereffi, Lin, Simpson, Smith,*

Tiryakian

- 227C. Proseminar in Medical Sociology: Organizing and Financing Health Care. *Maddox*

AREA COURSES: AFRICA

Arabic

- 100. North African Culture. (Taught in Morocco.) *Cooke or Cornell*

Art

- 173. Art, Architecture and Masquerade in Africa. *Powell*
- 174. Art and Philosophy from West Africa to the Black Americas. *Powell*

Cultural Anthropology

- 122. Modern Africa. *O'Barr*

French

- 168. Francophone Literature. *Mudimbe-Boyi*

History

- 115. History of Africa. *Ewald*
- 168S. The Atlantic Slave Trade. *Gaspar*
- 179. History of South Africa, 1600-1960. *Ewald*
- 195S.23. Issues in the History of Tropical Africa. *Ewald*

Political Science

- 100C.01. Politics and Literature in Southern Africa. (Taught in Africa.) *Johns*
- 100C.02. Issues of Development in Botswana and Zimbabwe. (Taught in Africa.) *Johns*
- 161S. Comparative Government and Politics: Africa. *Bates or Johns*
- 171. Politics of South African Apartheid. *Johns*

Religion

- 164. History and Religions of North Africa. *Cornell*

AREA COURSES: CANADA

English

- 186S. A. Canadian Literature in English. *A. Davidson*

French

- 131S. French in the New World. *Hull*
- 169. The Contemporary Novel in French Canada. *Keinig*

History

- 98. Introduction to Canada. *Cahow or Thompson*
- 108C. Canadian-American Relations. *Thompson*
- 183S. Canada from the French Settlement. *Cahow*
- 282S. Canada. *Cahow or Thompson*

Interdisciplinary Courses

- 184S. Canadian Issues. *Cahow or Thompson*

Literature

146. The Canadian Image: Cultural Production in French and English Canada. *A. Davidson*

AREA COURSES: CARIBBEAN

Art and Art History

174. Art and Philosophy from West Africa to the Black Americas. *Powell*

French

168. Francophone Literature. *Mudimbe-Boyi*

History

115. History of Africa. *Ewald*

- 124S. Slave Society in Colonial Anglo-America: The West Indies, South Carolina, and Virginia.

Gaspar

131. History of Mexico and the Spanish Caribbean in the Nineteenth and Twentieth Centuries.

TePaske

- 145A, 145B. Afro-American History. *Gavins*

- 168S. The Atlantic Slave Trade. *Gaspar*

174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence.

TePaske

- 195S.18. The Destruction and Aftermath of Slavery in the Americas: A Comparative Perspective. *J.*

Scott

- 195S.40. Fugitive Slave Communities (Maroon) in New World Slave Societies. *Gaspar*

206. Origins of Afro-America. *J. Scott*

- 233S. Slave Resistance and Social Control in New World Societies. *Gaspar*

Literature

180. Writings in the Rural Tradition: From the Caribbean to the American South. *Willis*

AREA COURSES: EAST ASIA

Art

172. Topics in Oriental Art. *Lee*

Chinese

129. Advanced Readings in Chinese. *Staff*

- 141S. The Fantastic in Chinese Fiction. *Wang*

- 148S. Literature and Revolution: From the May Fourth to the Post-Mao Era. *Wang*

- 183, 184. Topics in Modern Chinese. *Wang or Zhang*

- Additional Chinese courses are taught in Beijing and Nanjing as part of the Duke Study in China Program.

Cultural Anthropology

163. Foundations of Chinese Civilization. (Taught in China.) *Staff*

Economics

- 134/234. Japanese Economy and Its History. *Bronfenbrenner*

- 142/242. Chinese Economy. *Yang*

History

- 100J. Foundations of Chinese Civilization. (Taught in China.) *Staff*

- 101K. Topics in Chinese Civilization. *Dirlik*

- 101M. Asian-Pacific Region in Historical Perspective. *Dirlik*

- 122B. Japan: Population, Resources, and Development. *Wigen*

139. China since 1949: The People's Republic. *Dirlik*

142. China: Roots of Revolution. *Dirlik*

- 143A. Ancient and Early Modern Japan. *Gordon*

- 143B. The Emergence of Modern Japan. *Gordon*

- 195S.05. Japanese Women's History. *Wigen*

- 195S.08, 196S.08. Modern Chinese Thought. *Dirlik*

- 195S.17, 196S.17. Problems in the History of Modern Japan. *Gordon*

- 208S. Geographic Perspectives in History: Asia/Pacific. *Wigen*

- 245, 246. Social and Intellectual History of China. *Dirlik*

Japanese

175. Structure of Japanese. *Nagai*

- 183, 184. Topics in Japanese. *Nagai*

Music

138. Music in East and Southeast Asia. *Seebass*

Political Science

- 111. Contemporary Japanese Politics. *McKean*
- 132. Politics of Asia. *Lomperis*
- 133. Japanese Foreign Relations. *McKean*
- 149. United States and East Asia. *McKean*
- 169. Politics in Revolutionary China. *McKean*
- 241S. The Political Thought of Asia from Manu to Mao. *Lomperis*

Religion

- 141. Religions of China and Japan. *Corless*
- 149. Buddha and Buddhism. *Corless*
- 218. Religions of East Asia. *Corless*

Sociology

- 110B. Comparative Sociology: Asia. *Lin*

AREA COURSES: LATIN AMERICA

Art

- 178. Pre-Columbian Art and Architecture. *Reents-Budet*
- 193. Art and Culture of Mesoamerica. *Reents-Budet*
- 194. Maya Art and Culture. *Reents-Budet*
- 195. Pre-Columbian Art and Culture of Andean South America. *Reents-Budet*
- 257S. Topics in Pre-Columbian Art and Culture. *Reents-Budet*

History

- 104B. A Survey of Latin American History through Film. *TePaske*
- 131. History of Mexico and the Spanish Caribbean in the Nineteenth and Twentieth Centuries.

TePaske

- 136. Introduction to Contemporary Latin American Reality. *James*
- 172. Nineteenth- and Twentieth-Century Argentina and Brazil. *James*
- 173. History of Spain from Late Medieval Times to the Present. *TePaske*
- 174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence.

TePaske

- 177. Modern Latin America. *Staff*
- 195S.22, 196S.22. Problems in Latin-American History. *TePaske*
- 196S.29. Proletarians and Peasants, Bandits and Prophets: Social Movements in Nineteenth- and Twentieth-Century Latin America. *James*
- 230S. Populism in Latin America. *James*
- 231S. Readings in Latin American Colonial History. *TePaske*
- 265S. Problems in Modern Latin American History. *Staff*

Interdisciplinary Courses

- 198S. Current Topics on Latin America. *Staff*

Political Science

- 100B.01. Authoritarianism and Democracy in Brazil. (Taught in Brazil.) *Staff*
- 100B.02. Brazil in World Politics. (Taught in Brazil.) *Staff*
- 100B.03. United States-Latin American Relations. (Taught in Mexico.) *Staff*
- 151. Introduction to Latin-American Politics. *Archer*
- 253S. Comparative Government and the Study of Latin America. *Archer*

Portuguese

- 22S. Topics in Portuguese and Brazilian Literature and Culture. *Staff*
- 111S. Portuguese for Current Affairs. *Staff*
- 200S. Seminar in Portuguese Literature. *Staff*

Spanish

- 105, 106. Introduction to Spanish-American Literature. *Ross*
- 107S. Spanish-American Short Fiction. *Pérez Firmat*
- 121. Latin American Literature in Translation. *Dorfman*
- 143S. Literature of the Discovery and Conquest of America. *Staff*
- 144S. Spanish-American Literature of Identity. *Pérez Firmat*
- 145S. Literature of the Hispanic Minorities of the United States. *Pérez Firmat*
- 146. The Spanish-American Novel. *Staff*
- 147S. Latin American Women Writers. *Ross or staff*
- 166. Nineteenth-Century Prose Fiction. *Pérez Firmat or Sieburth*
- 210. History of the Spanish Language. *Garcí-Gómez*
- 245. Modern Spanish-American Poetry. *Staff*

AREA COURSES: MIDDLE EAST

Arabic

- 100. North African Culture. (Taught in Morocco.) *Cooke or Cornell*
- 125, 126. Advanced Arabic. *Cooke or Cornell*
- 171S. Modern Arabic Literature in Translation. *Cooke*
- 183, 184. Topics in Arabic. *Cornell*

Asian and African Languages and Literature

- 173S. Women in Arabic Literature. *Cooke*

Cultural Anthropology

- 126. Muslim World: Transformation and Continuities. *Ewing*

History

- 152. Modern Middle East. *Y. Miller*
- 195S.35. Palestine and the Arab-Israeli Conflict. *Y. Miller*

Interdisciplinary Courses

- 162, 163. Introduction to Islamic Civilization. *Cornell or Lawrence*

Political Science

- 100F.01. Israel from Utopia to History. (Taught in Israel.) *Staff*
- 235S. Comparative Development of Islam. *Staff*

Public Policy Studies

- 175S. The Palestine Problem and United States Public Policy. *Kuniholm*
- 257. United States Policy in the Middle East. *Kuniholm*

Religion

- 134. Jewish Mysticism. *Bland*
- 135. Jewish Religious Thought. *Bland*
- 136. Contemporary Jewish Thought. *Bland or E. Meyers*
- 164. History and Religions of North Africa. *Cornell*
- 283. Islam and Modernism. *Lawrence*
- 284. The Religion and History of Islam. *Lawrence*

AREA COURSES: RUSSIA AND EASTERN EUROPE

Economics

- 293. Soviet Economic History. *Trembl*
- 294S. Soviet Economic System. *Trembl*

History

- 110. History of Eastern Europe in Modern Times. *Lerner*
- 120. History of Socialism and Communism. *Lerner*
- 161. History of Modern Russia. *M. Miller*
- 180. The Soviet Experience. *Lerner*
- 195S.10. Jews in Eastern Europe in Modern Times. *Lerner*
- 195S.30. Problems in Russian History. *M. Miller*
- 201S. The Russian Intelligentsia and the Origins of the Revolution. *M. Miller*
- 202S. The Russian Revolution. *M. Miller*
- 239S. History of Socialism and Communism. *Lerner*
- 262. Problems in Soviet History. *Lerner*

Polish

- 100. Poland in Transition. (Taught in Poland.) *Pugh and staff*
- 174S. Topics in Polish Literature. *Staff*
- 187. Introduction to Polish Literature. *Staff*

Political Science

- 105. The Politics of Democratization in Eastern Europe. *Kitschelt*
- 165. Government and Politics of the Soviet Union. *Hough*
- 166. Soviet Foreign Relations. *Hough*

Russian

- 103, 104. Studies in Russian Language and Culture. (Taught in Russia.) *Staff*
- 129. Russian Orthodoxy. *Pelech*
- 130. Soviet Cinema. *Turovskaya*
- 131. Language, Culture, and Myth: The Slavic Proverb. *Dolgova*
- 135. Contemporary Soviet Media. *Andrews*
- 150. The Languages of the Soviet Union. *Pugh*

- 161, 162. Nineteenth-Century Russian Literature. *Staff*
- 169. Women and Russian Literature. *Gheith*
- 170. Russian Dissident and Emigré Literature. *Lahusen*
- 172S. Pushkin and His Time. *Gheith or Van Tuyl*
- 173S. Gogol. *Lahusen*
- 175. Tolstoy. *Staff*
- 176. Dostoevsky. *Staff*
- 177S. Chekhov. *Staff*
- 178. Leskov. *Gheith*
- 180. Early Twentieth-Century Russian Literature: From Symbolism to the 1920s. *Lahusen*
- 181. The 1920s: The Road to a New Synthesis. *Dobrenko or Lahusen*
- 182. Socialist Realism: Soviet Literature of the 1930s and 1940s. *Dobrenko or Lahusen*
- 183. Post-Stalinist and Contemporary Soviet Literature. *Dobrenko or Lahusen*
- 184. Literature under and after Glasnost. *Dobrenko, Gheith, or Lahusen*
- 185S. Introduction to Slavic Linguistics. *Andrews*
- 186S. History of the Russian Language. *Pugh*
- 188, 189. Advanced Russian Language and Culture. (Taught in Russia.) *Staff*
- 190. Introduction to Russian Civilization. *Palach*
- 195. Advanced Russian. *Andrews or Maksimova*
- 196. Advanced Russian: Readings, Translation, and Syntax. *Andrews*
- 269. Women and Russian Literature. *Gheith*

AREA COURSES: SOUTH ASIA

Asian and African Languages and Literature

- 137. Contemporary Culture in South Asia. *Khanna*
- 138. The Media in Modern India. (Taught in India.) *Khanna*

Cultural Anthropology

- 120. South Asia: Institutions and Change. *Apte or Ewing*

History

- 100E. Indian History and the Present. (Taught in India.) *Kumar*
- 164. India, Pakistan, and Bangladesh: 1750 to the Present. *Richards*
- 195S.21. Problems in Indian History. *Richards*
- 247. History of Modern India and Pakistan. *Richards*
- 248. History of Modern India and Pakistan: 1857 to the Present. *Richards*

Interdisciplinary Courses

- 101, 102. Introduction to the Civilizations of Southern Asia. *Khanna or staff*
- 162, 163. Introduction to Islamic Civilization. *Lawrence and staff*

Music

- 138. Music in East and Southeast Asia. *Seebass*

Political Science

- 132. Politics of Asia. *Lomperis*

Religion

- 149. Buddha and Buddhism. *Corless*
- 217. Islam in India. *Lawrence*

AREA COURSES: WESTERN EUROPE

Art

- 100. Art and Architecture of Vienna. (Taught in Austria.) *Staff*
- 152. Art of the Netherlands in the Sixteenth Century. *Van Miegroet*
- 153. Art of the Northern Netherlands in the Seventeenth Century. *Van Miegroet*
- 154. German Art in the Fifteenth and Sixteenth Centuries. *Van Miegroet*
- 155. Mercantile Culture and Arts in the Netherlands. *de Marchi and Van Miegroet*
- 156. Art of the Southern Netherlands in the Seventeenth Century. *Van Miegroet*
- 158, 159. Art and Cultural History of Flanders and the Netherlands from the Fifteenth through the Seventeenth Centuries. (Taught in Belgium/Holland.) *Van Miegroet*
- 161. Nineteenth-Century Art, 1789-1848: Revolution to Revolution. *Cernuschi*
- 167. Twentieth-Century Art, 1900-1945. *Cernuschi or Stiles*
- 187. Surrealism. *Stiles*

Cultural Anthropology

- 139. Marxism and Society. *Wilson*

Distinguished Professor Course

192. French Existentialism: 1940-1960. *Mudimbe*

Economics

- 60. Economics of a United Europe. (Taught in Germany.) *Staff*
- 150. History of Economic Thought (Taught in Holland.) *de Marchi or Goodwin*
- 151. Adam Smith and the System of Natural Liberty. *de Marchi*

French

- 107S. Contemporary Ideas. *Staff*
- 108S. French Women: Myths, Realities, and the Law. *Staff*
- 111S. French for Current Affairs. *Staff*
- 113. French for Business and Law. *Staff*
- 136S. Life in Eighteenth-Century France. *Stewart*
- 137. Aspects of Contemporary French Culture (Taught in France.) *Staff*
- 139. French Civilization. *Keinig or Tetel*
- 145S. Topics in Renaissance Literature and Culture. *Tetel*
- 153. The French Enlightenment. *Stewart*
- 166, 167. Contemporary French Life and Thought. *Kaplan*

Germanic Languages and Literature

- 100S. Business German. *Staff*
- 124S. Contemporary German Women Writers. *Staff*
- 136S. Contemporary Germany. *Bessent or Hell*
- 152S. Berlin in Contemporary German Literature. (Taught in Germany.) *Staff*
- 153. Aspects of Contemporary German Culture. (Taught in Germany.) *Staff*
- 160. German Life and Thought. *Borchardt*
- 245S. The Twentieth Century. *Rolleston*
- 247S. Postwar German Literature. *Hell*
- 270. Consciousness and Modern Society. *Rolleston*

History

- 100A. History of Modern Spain. (Taught in Spain.) *Staff*
- 100B. History of Renaissance Italy. (Taught in Italy.) *Witt or staff*
- 100C. Nineteenth-Century European Political History. (Taught in France.) *Staff*
- 100G. Twentieth-Century Economic and Social History of France, 1860-1944. (Taught in France.)

Staff

- 100K. History of Spain from Late Medieval Times to the Present. (Taught in Spain.) *Staff*
- 100L. German History from 1870 to 1970. (Taught in Germany.) *Staff*
- 100R. History of Austria. (Taught in Austria.) *Staff*
- 107A, 107B. History of England. *Cdl or Herrup*
- 113. British Society from Industrialization to Empire (1792-1914). *Thorne*
- 117. Early Modern Europe. *Neuschel*
- 135A. Germany from the Thirty Years' War to Unification in 1871. *Koonz*
- 135B. Germany from 1871 to 1933. *Koonz*
- 135C. Germany from 1933 to 1990. *Koonz*
- 138. Renaissance and Reformation Germany. *Robisheaux*
- 171A. History of Women in Early Modern Europe. *Neuschel*
- 171B. History of Women in Modern Europe. *Neuschel*
- 173. History of Spain from Late Medieval Times to the Present. *TePaske*
- 195S.07. Religion and Society in Modern British History. *Thorne*
- 195S.11. Europe and the World since 1914. *W. Scott*
- 195S.12. Europe and the World since 1939. *W. Scott*
- 195S.13. Problems in Early Modern English History. *Herrup*
- 195S.15. Society and Polity in France, 1700 to the Present. *Reddy*
- 195S.26. State and Society in the Third Reich. *Koonz*
- 195S.28. The Spanish Civil War and Its Aftermath. *TePaske*
- 195S.31. History and Memory of Nazi Genocide. *Koonz*
- 195S.44. Popular Patriotism in Modern British History. *Thorne*
- 204. German Society: 1914-1945. *Koonz*
- 214. Class, Public Opinion, and the French Revolution. *Reddy*
- 221. Topics in Social and Economic History of Europe, 1200-1700. *Staff*
- 251B. Topics in the Intellectual History of Europe, 1450, 1650. *Witt*
- 253S, 254S. European Diplomatic History, 1871-1945. *W. Scott*
- 258S. Social Conflict in Weimar and Nazi Germany. *Koonz*
- 267S. England in the Sixteenth Century. *Herrup*
- 268S. England in the Seventeenth Century. *Herrup*
- 269S-270S. British History, Seventeenth Century to the Present. *Cdl*

Interdisciplinary Courses

199S. Senior Seminar in German Studies. *Rolleston*

Italian

- 105. Italian Women Writers. *Finucci*
- 131. Topics in Italian Civilization. *Finucci*
- 155S. Nineteenth-Century Italian Literature. *Caserta*
- 170. Film and the Italian Novel. *Finucci*
- 283. Italian Novel of the Novecento. *Caserta*

Literature

- 132. Dada and Surrealism. *Thomas*

Music

- 119. The Humanities and Music. *Bartlett or Seebass*
- 120. Women in Music. *Staff*
- 143. Beethoven and His Time. *Bartlett, Gilliam, Silbiger, or Todd*
- 144. Bach and His Time. *Meniker or Silbiger*
- 145. Mozart and His Time. *Seebass or Silbiger*
- 156S. Music History II: Late Renaissance, Baroque. *Bartlett, Brothers, Meniker, Seebass, or Silbiger*
- 157S. Music History III: Rococo and Classic. *Bartlett, Seebass, Silbiger, or Todd*
- 158S. Music History IV: Romanticism and the Modern Period. *Bartlett, Gilliam, Silbiger, or Todd*

Political Science

- 100A.01. Environmental Policy in Europe. (Taught in Germany.) *Staff*
- 100A.02. From Division to Unification. (Taught in Germany.) *Staff*
- 100E.01. British Government and Politics. (Taught in England.) *Staff*
- 100E.02. Media and Politics in Britain. (Taught in England.) *Staff*
- 100H.01. Italian Politics from the Risorgimento to the Present. (Taught in Italy.) *Staff*
- 100J.01. Government and Politics of Austria in Europe. (Taught in Austria.) *Staff*
- 100K.02. British Government and Constitutional Law. (Taught in England.) *Staff*
- 100L.01. Political System of Modern Britain. (Taught in England.) *Staff*
- 100M.01. Government and Politics of Spain. (Taught in Spain.) *Staff*
- 115. Politics and Society in Germany. *Kitschelt*
- 135. Political Development of Western Europe. *Kitschelt or Lange*
- 136. Comparative Government and Politics: Western Europe. *Kitschelt or Lange*
- 170. Europe Transformed. *Grieco*
- 181. Marxism and Neo-Marxism. *Coles*
- 216S. Evolution of European Marxism. *Coles*
- 225. Topics in Comparative Government and Politics: Western Europe. *Kitschelt or Lange*
- 232. Political Economy: Theory and Applications. *Lange*
- 244S. The Politics of the European Community. *Grieco*

Religion

- 167. The Reformation of the Sixteenth Century. *Hüllerbrand*
- 168. Religion and Society in Early Modern Europe. *Hüllerbrand*

Sociology

- 138. History of Social Thought. *Tiryakian or Wilson*
- 188. The Sociology of Contemporary Spain. *Staff*

Spanish

- 137. Aspects of Contemporary Spanish Culture. *Garci-Gómez*
- 138. Spanish Civil War in History and Literature. *Sieburth*
- 166. Nineteenth-Century Prose Fiction. *Pérez Firmat or Sieburth*
- 171. Literature of Contemporary Spain. *Osuna*
- 210. History of Spanish Language. *Garci-Gómez*

THE MAJOR

Corequisite Foreign Language Requirement: Four (4) semester courses in a single language of the primary area are required. Students with advanced placement credits or other evidence of foreign language proficiency are not exempted from this requirement. However, in the following cases students may substitute one or two nonlanguage courses to meet this requirement: (1) if a second year of a language is not taught at Duke or (2) if no language course is available at a sufficiently advanced level. In these cases, approved humanities or social science courses taught in a foreign language, or a year of general linguistics or literature in translation, may be substituted for the second year of

a language. The specific language courses are too numerous to list here. Area advisors should be consulted for specific approval of the language choice if it does not conform to the list below.

Africa: Swahili; Arabic or relevant European languages such as French and Portuguese may be used if appropriate to specific programs.

Canada: French.

Caribbean: French, Spanish.

East Asia: Chinese, Japanese.

Latin America: Spanish; Portuguese for specialization in Brazil.

Middle East: Arabic, Persian; modern Hebrew for specialization in Israel.

Russia and Eastern Europe: Russian; relevant Eastern European language.

South Asia: Hindi-Urdu.

Western Europe: French, German, Italian, Portuguese, Spanish.

Major Requirements:

1. **Introductory Courses:** Two (2) introductory courses emphasizing comparative approaches from two different departments. Students may also satisfy this requirement by taking both Comparative Area Studies 109 and Comparative Area Studies 110. See list under Introductory Courses.
2. **Primary Area Courses:** Four (4) semester courses in the geographical area of special interest (the area of the language studied). Areas and courses are listed above. Others may be selected with the consent of the director.
3. **Secondary Concentration:** The secondary concentration is intended to provide a comparative perspective on the student's primary area of study and to focus attention on Third World as well as Western Societies. A student must take three (3) courses in either a second geographic area or in comparative/global issue courses. Qualifying courses are listed above.

Students who choose Western Europe, Canada, or Russia/Eastern Europe as a primary area must take a non-European or comparative/global issue secondary concentration. Similarly, students who choose either Latin America or the Caribbean as their primary area may not take the other of this pair as the secondary concentration. Students who choose Canada as a primary area may not take Western Europe as the secondary concentration.

4. **Comparative Area Studies 125, Strategies of Comparative Analysis.** This course is taught by faculty members affiliated with comparative area studies and is open only to majors. The purpose of this course is to teach students the various strategies that can be employed in making appropriate comparisons within and across distinct regions of the world. The course combines a lecture format with discussion sections, and students are encouraged to write papers that reflect the cross-cultural and interdisciplinary objectives of the major. Students should take this course in their sophomore or junior year, not in their senior year.

Honors Seminar: For graduation with distinction or Latin honors by honors project, a research project is completed in the senior year, usually in the Comparative Area Studies 150S senior seminar. Candidates will apply in their junior year and will be selected by the Comparative Area Studies faculty. Selection criteria include the feasibility of the proposed topic, and the student's motivation and skills to carry it out successfully.

Inquiries should be addressed to the Director, Comparative Area Studies, 2122 Campus Drive.

Computer Science (CPS)

Professor Loveland, *Chair*; Research Associate Professor Ramm, *Associate Chair*; Professor Biermann, *Director of Undergraduate Studies*; Professors Behringer, Marinos, Patrick,

Reif, Rose, Starmer, Trivedi, and Utku; Associate Professors Agarwal, Dugan, Ellis, Gardner, Greenside, Kadem, and Wagner; Assistant Professors Chowdhury, Dollas, Holliday, Kao, Lanzkron, Nadathur, and Prisant; Professor Emeritus Gallie; Assistant Professor of the Practice Astrachan; Research Assistant Professors Pantazis and Tate; Adjunct Professors Brglez, Coughran, and Kootsey

A major is available in this department.

The Department of Computer Science provides courses on the concepts of computing and computers, their capabilities, and uses. In most courses students make extensive use of the available computing facilities. Students who wish to take a single introductory course, as part of their general education, usually elect either Computer Science 10 or 50.

In cooperation with the Microelectronics Center of North Carolina (MCNC), the University of North Carolina at Chapel Hill, and other MCNC-affiliated universities in North Carolina, the department often sponsors advanced computer science and other high technology courses originating at other universities. These are available through a closed circuit television and data network belonging to MCNC. Contact the Department of Computer Science for further information on the availability of such courses.

10. Computer Science Fundamentals. (QR) An overview for students not intending to major in computer science. Computer programming, symbolic and numeric computation, electric circuits, architectures, translation, time complexity, noncomputability, and artificial intelligence. Not open to students having credit for Computer Science 50 or higher. One course. *Biermann and staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

50. Introduction to Pascal Programming. (QR) A study of clear thinking and problem solving using the computer. Representation, problem decomposition, and structured programming. Students learn the Pascal language and develop skills by solving a variety of symbolic and numerical problems. One course. *Staff*

52. Introduction to Program Design and Analysis I. (QR) Problem-solving techniques using a computer, top-down decomposition and solution methodologies, introduction to programming, programming in the C language, introduction to UNIX and programming environments, recursion, analysis of execution times, pushdown stacks and their uses, linked data structures, searching and sorting. Normally the first course for majors in computer science who have no programming experience. One and one-half courses. *Staff*

53. Program Design and Analysis I. (QR) Similar to Computer Science 52 except that introductory programming is omitted. Normally the first course for majors in computer science who have proficiency in a computer programming language. (Not open to students who have had Computer Science 52.) One course. *Staff*

103. Program Design and Analysis II. (QR) A continuation of Computer Science 52 or 53. Overview of advanced data structures and analysis of algorithms, proofs of correctness, algorithm synthesis, and noncomputability. One course. *Staff*

104. Computers and Programming. (QR) Computer structure, machine language, instruction execution, addressing techniques, and digital representation of data. Computer systems organization, logic design, microprogramming, and interpreters. Symbolic coding and assembly systems. Prerequisite: Computer Science 103 or consent of instructor. One course. *Ramm and staff*

106. Programming Languages. (QR) Syntax and semantics of programming languages. Compilation, interpretation, and programming environments; including pro-

gramming languages such as Algol, PL/1, Pascal, APL, LISP, and Prolog. Exercises in programming. Prerequisite: Computer Science 104. One course. *Staff*

115. Methodologies in Artificial Intelligence. (QR) Theories of representation and search in artificial intelligence. Logic, semantic networks, production rules, frames, distributed models, and procedural representations; algorithmic and heuristic search. One course. *Biermann, Loveland, or Nadathur*

121. Introduction to Numerical Methods. (QR) Numerical solution of systems of linear and nonlinear equations and of ordinary differential equations. Polynomial and spline interpolation. Integration. Least squares. Prerequisites: Computer Science 103 and Mathematics 103 and 104. One course. *Staff*

125. Mathematical Foundations of Computer Science. (QR) An introduction to theoretical computer science including studies of abstract machines, the language hierarchy from regular sets to recursively enumerable sets, noncomputability, and complexity theory. Prerequisites: Computer Science 53 and 103 and Mathematics 103. One course. *Loveland*

131. Introduction to Operating Systems. (QR) Basic concepts and principles of multiprogrammed operating systems. Processes, interprocess communication, CPU scheduling, mutual exclusion, deadlocks, memory management, I/O devices, file systems, protection mechanisms. Prerequisites: Computer Science 103 and 104. One course. *Holliday*

155. Program Design and Construction. (QR) Substantial programs. Design specifications, choice of data structures, estimation of programming effort, stepwise development, and program-testing methodology. Programming teams and human factors in system implementation. Advanced topics in use of a procedural language and file management. Prerequisite: Computer Science 104. One course. *Staff*

157. Introduction to Switching Theory and Logic Design. (QR) See C-L: Electrical Engineering 151. One course. *Marinos or Overhauser*

174. Analysis of Algorithms. (QR) Design and analysis of efficient algorithms for sorting, searching, dynamic structure manipulation, pathfinding, fast multiplication, and others; nondeterministic algorithms and computationally hard problems. Prerequisites: Computer Science 103 and four semesters of college mathematics. One course. *Agarwal, Kao, or Reif*

185S. Seminar in Research Practice and Methodology. (QR) Methodologies in the formulation, analysis, and solution of ill-posed and ill-structured problems. General research techniques, mathematical modeling, search methodologies, experimental design, simulation, statistical analysis, report writing. Prerequisites: four courses in mathematics (MTH 31 or above), four courses in computer science (CPS 53 or above), and one course in statistics. One course. *Biermann and staff*

191, 192. Independent Study. Directed reading and research for qualified juniors. Consent of instructor and Director of Undergraduate Studies required. One course each. *Staff*

193, 194. Independent Study. Directed reading and research for qualified seniors. Consent of instructor and Director of Undergraduate Studies required. One course each. *Staff*

196. Topics in Computer Science. (QR) Topics from various areas of computer science, changing each year. Prerequisites: Computer Science 53 and 103 or equivalent. One course. *Staff*

For Seniors and Graduates

200. Programming Methodology. (QR) Practical and theoretical topics including structured programming, specification and documentation of programs, debugging and testing strategies, choice and effective use of programming languages and systems, psychology of computer programming, proof of correctness of programs, analysis of algorithms, and properties of program schemata. Prerequisite: Computer Science 103. One course. *Staff*

201. Programming Languages. (QR) Information binding, data structures and storage, control structures, recursion, execution environments, input/output; syntax and semantics of languages; study of PL/1, Fortran, Algol, APL, LISP, SNOBOL, and SIMULA; exercises in programming. Prerequisite: Computer Science 200. One course. *Staff*

202. Applied Discrete Structures. (QR) Aspects of discrete mathematics that are essential to the development of computer science. Topics from combinatorics and graph theory, discrete probability theory, and mathematical logic. Prerequisites: Mathematics 103 and 104 or equivalents. One course. *Staff*

205. Analysis of Algorithms. (QR) Design and analysis of efficient algorithms. Algorithmic paradigms. Applications include sorting, searching, dynamic structures, graph algorithms, randomized algorithms. Computationally hard problems. NP completeness. Prerequisite: Computer Science 103 or equivalent. One course. *Agarwal, Kao, or Reif*

206. Numerical and Algebraic Algorithms. (QR) Introduction to polynomial problems, matrix problems—general and sparse; numerical algorithms, fast Fourier transform, eigenvalue computation, number theory and cryptography. Prerequisites: Computer Science 205 and 222, or equivalents. One course. *Reif or Rose*

207. Fault-Tolerant Computer Systems. Prerequisite: Electrical Engineering 151 or equivalent. See C-L: Electrical Engineering 254. One course. *Marinos*

210. Introduction to VLSI Systems. A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Prerequisite: Electrical Engineering 151 or equivalent; Electrical Engineering 161 or equivalent. One course. *Dollas or Kedem*

212. Introduction to Scientific Computing. Practical introduction for students and faculty to computer resources that facilitate scientific research: scientific word processing (Tex and LaTeX), symbolic manipulation programs, software tools, numerical software packages, and graphics. Case studies used to illustrate these resources. For noncomputer scientists. Prerequisite: Mathematics 103, 104, or equivalent; some programming experience. One course. *Gardner or Greenside*

213. Nonlinear Dynamics. (QR) Introduction to the mathematical theory of nonlinear dynamics, and how this theory compares with physical experiments, with applications to biology (Turing states and morphogenesis), computer science (randomness and computability), mathematics (chaos and strange attractors), and physics (pattern formation and transition to turbulence). Prerequisites: Computer Science 53, Mathematics 111, and Physics 51L, 52L. C-L: Physics 213. One course. *Behringer*

215. Artificial Intelligence. (QR) Heuristic versus algorithmic methods; programming of games such as chess; theorem proving and its relation to correctness of programs; readings in simulation of cognitive processes, problem solving, semantic

memory, analogy, adaptive learning. Prerequisite: Computer Science 103 or consent of instructor. One course. *Biermann, Loveland, or Nadathur*

218. Logic for Computer Science. (QR) Aspects of logic with a focus on computational issues. Topics include propositional and predicate calculi and the theory underlying their automation, that is, the compactness theorems, the Herbrand-Skolem-Gödel theorem, unification, and resolution. Proof procedures and their search characteristics. The use of natural deduction and sequent calculi in describing logics, specifying programming language semantics and formalizing type systems. Structural properties, such as cut-elimination, in such systems. The logical systems underlying programming languages like Prolog and ML. Applications of logic in automated reasoning, program verification and synthesis. C-L: Philosophy 210. One course. *Loveland or Nadathur*

221. Numerical Analysis. (QR) Error analysis, interpolation and spline approximation, numerical differentiation and integration, solutions of linear systems, nonlinear equations, and ordinary differential equations. Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. C-L: Mathematics 221 and Statistics 273. One course. *Gardner or Greenside*

222. Numerical Differential Equations. (QR) Numerical methods for solving ordinary and partial differential equations emphasizing nonlinear differential equations. Methods for solving ordinary differential equations that generalize to solve partial differential equations: finite difference, spectral, and finite element methods. Solution of hyperbolic, parabolic, and elliptical partial differential equations arising in scientific problems. Prerequisite: Computer Science 221. C-L: Mathematics 222. One course. *Gardner, Greenside, or Rose*

223. Numerical Linear Algebra. (QR) Solution of large, sparse linear systems of equations. Storage schemes, graph theory for sparse matrices, different orderings to minimize fill, block factorizations, iterative methods, analysis of different splittings, conjugate gradient methods. Eigenvalue problems, QR factorization, Lanczos method, power method and inverse iteration, Rayleigh quotient. Prerequisite: Computer Science 221 or equivalent. C-L: Mathematics 223. One course. *Gardner, Greenside, or Rose*

225. Formal Languages and Theory of Computation. (QR) An introduction to the study of abstract machines and the languages they define, their capabilities, and limitations. Finite-state automata, regular languages, pushdown automata, context-free languages, Turing machines, recursive functions and recursively enumerable sets, non-computable sets, measures of complexity for algorithms. Prerequisite: four courses in college mathematics. One course. *Loveland or Reif*

226. Mathematical Methods for Systems Analysis I. (QR) Basic concepts and techniques used in the stochastic modeling of systems. Elements of probability, statistics, queuing theory, and simulation. Prerequisite: four semesters of college mathematics. C-L: Electrical Engineering 255. One course. *Trivedi*

230. Parallel Algorithms. (QR) Models of parallel computation including parallel random access machines, circuits, and networks; NC algorithms and P-completeness; graph algorithms, sorting algorithms, network routing, tree contraction, string matching, parsing algorithms; randomization and derandomization techniques. Prerequisite: Computer Science 205 or equivalent. One course. *Kao or Reif*

231. Operating Systems. (QR) Fundamental principles of operating system design applied to state-of-the-art computing environments (multiprocessors and distributed systems) including process management (coscheduling and load balancing), shared memory management (data migration and consistency), and distributed file systems. Advanced topics include transaction-based operating systems, reliable communication

protocols, concurrency control and recovery mechanisms, computer security, and performance analysis. One course. *Ellis*

232. Compiler Construction. (QR) Models and techniques used in the design and implementation of assemblers, interpreters, and compilers. Lexical analysis, compilation of arithmetic expressions and simple statements, specifications of syntax, algorithms for syntactic analysis, code generation and optimization techniques. One course. *Chowdhury*

240. Computational Geometry. (QR) Models of computation and lower-bound techniques; storing and manipulating orthogonal objects; orthogonal and simplex range searching, convex hulls, planar point location, proximity problems, arrangements, linear programming and parametric search technique, probabilistic and incremental algorithms. Prerequisite: Computer Science 205 or equivalent. One course. *Agarwal or Reif*

241. Data Base Methodology. (QR) Basic concepts and principles. Relational, hierarchical, and network approaches to data organization; data entry and query language support for data base systems; theories of data organization; security and privacy issues. Prerequisites: Computer Science 104 and either 155 or equivalent. One course. *Holliday*

245. Functional Analysis for Scientific Computing. (QR) Linear spaces, topologies, norms, and completeness. Focus on Banach and Hilbert spaces including Sobolev spaces. Linear and nonlinear operators. Fréchet derivatives. Iterative methods for nonlinear operator systems, such as Newton-like methods. Applications. Intended for science and engineering students but not mathematics graduate students. Prerequisite: Computer Science 221. C-L: Mathematics 245. One course. *Rose*

252. Computer Systems Organization. Hardware and software aspects. Processor, memory, device, and communication subsystems; case studies of hardware system organization, for example, parallel, associative, fault-tolerant; organization of software systems to exploit hardware systems organization; economic and reliability aspects of various hardware organizations. Prerequisites: Computer Science 104 and 157. One course. *Wagner*

255. Computer Networks and Distributed Systems. (QR) Basic systems support for process-to-process communications across a computer network. The TCP/IP protocol suite and the Berkeley sockets application programs interface. Development of network application programs based on the client-server model. Remote procedure call and implementation of remote procedure call. Prerequisite: knowledge of the C programming language. One course. *Chowdhury*

265. Advanced Topics in Computer Science. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

227. Mathematical Methods for Systems Analysis II. (QR)

276. Communication, Computation, and Memory in Biological Systems. (QR)

THE MAJOR

A more complete description of the majors is available from the chair's office or from the Director of Undergraduate Studies.

For the A.B. Degree

Prerequisites. Mathematics 31, 32, and 104.

Major Requirements. Computer Science 53, 103, 104, 131, and 174; three electives at the 100 level or above: one in mathematics, one in computer science, and one in either

mathematics, computer science, or electrical engineering; and Mathematics 135 or Statistics 112. Suggested sequences to fill these elective slots would be a scientific computing sequence: Mathematics 103, Computer Science 121, and an elective, or the general symbolic computation sequence: Mathematics 187, Computer Science 115, and possibly Computer Science 185. If Mathematics 135 is elected, it is strongly recommended that it be followed by Mathematics 136. Students must complete at least five additional courses at the 100 level or above (excluding the above listed requirements) in one department other than computer science or in an approved area. The Director of Undergraduate Studies may be consulted concerning approved areas if the student does not wish to take all five courses from one department.

For the B.S. Degree

Prerequisites. Chemistry 11L; Mathematics 31, 32, 103, 104; Physics 51L and 52L.

Major Requirements. Computer Science 53, 103, 104, 121, 125, 131, and 174; two elective courses at the 100 level or above in computer science, electrical engineering, or mathematics; Electrical Engineering 151; Mathematics 135 or Statistics 112; and Mathematics 124 or 187. If Mathematics 135 is selected, it is recommended that Mathematics 136 be taken also.

Honors/Distinction

Students who are qualified (see the section on honors in this bulletin) may undertake work leading to a B.A. or B.S. degree with distinction in computer science by applying to the Director of Undergraduate Studies. Normally, candidates must have grades of A in computer science courses. They must complete a substantial project, suitably documented, or a distinguished paper on which they will be examined orally by a committee of three faculty members.

Cultural Anthropology (CA)

Associate Professor Quinn, *Chair*; Assistant Professor Starn, *Director of Undergraduate Studies*; Professors Apte, Mudimbe (literature), O'Barr, and Reddy (history); Associate Professor Silverblatt; Assistant Professors Allison, Ewing, and Strauss; Professors Emeriti Friedl and LaBarre; Adjunct Professor Conley; Lecturer Luttrell

A major is available in this department.

Cultural anthropology is a comparative discipline that studies the world's peoples and cultures. It extends perspectives developed from anthropology's initial encounter with the "primitive" world to studies of complex societies including rural and urban segments of the Third World and contemporary industrial countries. Cultural anthropologists at Duke concentrate on political economy, culture, ideology, history, and discourse, and the relations among them. These concerns lead them to such specific research and teaching interests as: colonialism and state formation; the role of culture in cognition; the politics of representation and interpretation; the bases of ideological persuasion and resistance; gender ideology; language use in institutional contexts; class formation and political consciousness; the creation and use of ethnic and national identities. The department also offers courses that introduce the various traditional subfields of cultural anthropology, and other, integrative courses on world areas. Students without prerequisites for a course may ask the instructor for admission.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

94. Introduction to Cultural Anthropology. (SS) Theoretical approaches to analyzing cultural beliefs and practices cross-culturally; application of specific approaches to case material from present and/or past cultures. C-L: Comparative Area Studies. One course. *Staff*

100. Foundations of Cultural Anthropology. (SS) Major schools and theories of cultural anthropology. Required course for cultural anthropology majors. Normally taken in sophomore or junior years. C-L: Comparative Area Studies. One course. *Staff*

101, 102. Introduction to the Civilizations of Southern Asia. (CZ) See C-L: Interdisciplinary Course 101, 102; also C-L: Asian and African Languages and Literature 160, 161; Comparative Area Studies; History 193, 194; and Religion 160, 161. One course each. *Khanna or staff*

105S. Theme Seminar. Topics vary. One course. *Staff*

107. Introduction to Linguistics. (SS) Origin and nature of language; methods of descriptive linguistics with reference to historical and comparative linguistics. C-L: English 111, Interdisciplinary Course 111, and Linguistics. One course. *Butters or Tetel*

109. Contemporary Global Issues. (SS) See C-L: Comparative Area Studies 109; also C-L: History 109, Political Science 160, and Sociology 175. One course. *Staff*

110. Advertising and Society. (SS) History and development of commercial advertising; advertising as a reflector and/or creator of social and cultural values; advertisements as cultural myths; effects on children, women, and ethnic minorities; advertising and language; relation to political and economic structure; and advertising and world culture. Primary emphasis on American society with consideration of selected other cultures. C-L: English 120, Film and Video, Sociology 160, and Women's Studies. One course. *Luttrell, O'Barr, Smith, or Wilson*

111. Anthropology of Law. (SS) Comparative approach to jurisprudence and legal practice, dispute resolution, law-making institutions and processes, and the relation of law to politics, culture, and values. One course. *Conley or O'Barr*

112. Current Topics in Linguistics. (SS) Advanced study of an area of linguistics or grammar. C-L: English 119, Interdisciplinary Course 119, and Linguistics. One course. *Staff*

113. The Cultural Construction of Gender. (SS) Explanation of differing gender beliefs cross-culturally. Comparison of these belief complexes with dominant themes about gender in our own culture and history, in contemporary ideological struggles, and most especially, in gender origin myths constructed by social scientists. C-L: Women's Studies. One course. *Allison or Quinn*

114. Gender Inequality. (SS) Universalistic theories of gender inequality posited on biological sex differences and differences in early psychological experience. Evolutionary theories that point to the existence of egalitarian societies and the appearance of gender inequality only with the emergence of ranking, stratified societies. The rise of the state; examination of the form of gender inequality in state societies. C-L: Comparative Area Studies and Women's Studies. One course. *Quinn or Starn*

116. Language, Ethnicity, and New Nations. (SS) Examination of the issues involved in language policy and planning and their impact on national integration in the newly independent multiethnic and multilingual nations of Asia and Africa. One course. *Staff*

118S. The Language of Advertising. (SS) Topics include: history and development of the genre of advertising language; comparisons to the specialized language used in medical, legal, and other professional contexts; and relation of topics to sociolinguistic theories and anthropological field methods. Primary focus on American television, print, and radio advertising and consideration of advertising language in certain other cultures. Directed field projects. Prerequisite: Cultural Anthropology 110 or consent of instructor. C-L: Film and Video and Linguistics. One course. *O'Barr*

119. Language, Culture, and Society. (SS) Analysis of language behavior within and across societies. Topics include the relation of language structures to cultural values, the role of speech in expressing and creating relations of power and intimacy, and the way social ideologies shape different kinds of discourse. C-L: Comparative Area Studies and Linguistics. One course. *Apte, O'Barr, or Strauss*

120. South Asia: Institutions and Change. (CZ) Cultures and societies of India, Pakistan, Sri Lanka, Bangladesh, Nepal, and Bhutan with emphasis on social institutions, behavioral patterns, value systems, and sociocultural change. C-L: Comparative Area Studies. One course. *Apte or Ewing*

122. Modern Africa. (CZ) Cultures and societies of Africa through the study of kinship, politics, economics, ecology, religion, and aesthetics in the context of colonialism and postcolonialism. C-L: African and Afro-American Studies 122 and Comparative Area Studies. One course. *O'Barr*

124S. American Indian Peoples. (CZ) Past and contemporary conditions of American Indian life, with an emphasis on North America. Social and political organization, gender relations, changing economic patterns, cultural themes and variations, spirituality, the effects of anti-Indian wars, policies, and prejudice, and the emergence of movements for self-determination. C-L: Comparative Area Studies. One course. *Staff*

125. Strategies of Comparative Analysis. (SS) See C-L: Comparative Area Studies 125; also C-L: History 137, Political Science 125, Religion 121, and Sociology 125. One course. *Staff*

126. Muslim World: Transformations and Continuities. (SS) The diversity of social practices within the community of Islam. Particular emphasis on gender relations, religious movements, and social change. C-L: Comparative Area Studies and Women's Studies. One course. *Ewing*

135. United States' Culture: Research and Analysis. (SS) The meaning of United States' culture viewed through topics such as individualism, love, marriage, religion, ethnicity, racism, poverty, wealth, gender, and family. One course. *Luttrell, Quinn, or Strauss*

139. Marxism and Society. (SS) A critical appraisal of Marxism as a scholarly methodology for understanding human societies. The basic concepts of historical materialism, as they have evolved and developed in historical contexts. Topics include sexual and social inequality, alienation, class formation, imperialism, and revolution. Core course for the program in Perspectives on Marxism and Society. C-L: Comparative Area Studies, Education 139, History 186, Interdisciplinary Course 139, and Sociology 139. One course. *Wilson*

143. Education, Culture, and Society. (SS) How social divisions and inequalities are created and challenged through the schooling process. Primary emphasis on American education. One course. *Luttrell*

145. Medical Anthropology. (SS) The role of cultural beliefs, social organization, poverty, and privilege in shaping disease and illness, healing and health care delivery, and patient-healer relationships. One course. *Staff*

147, 148. Introduction to Islamic Civilization. (CZ) See C-L: Interdisciplinary Course 162, 163; also C-L: Comparative Area Studies; History 101G, 102G; Medieval and Renaissance Studies; and Religion 162, 163. One course each. *Cornell, Lawrence, and staff*

151. Culture and Thought. (SS) The cultural basis of understanding, including feeling, motivation, and cognitive tasks such as reasoning and categorizing. Reconstruct-

tion of cultural assumptions from discourse. Evidence for cross-cultural variation and cultural universals in human thought. Not open to students who have taken Cultural Anthropology 251 (Cognitive Anthropology). One course. *Quinn or Strauss*

163. Foundations of Chinese Civilization. (CZ) The contemporary experience in China and its relation to ethnic, spiritual, social, aesthetic, moral, political, and economic themes in China's past. (Taught in China.) Not open to students who have taken History 163. C-L: Comparative Area Studies and History 100J. One course. *Staff*

165. Psychological Anthropology. (SS) Theoretical approaches to questions concerning the relationship between the individual and society and the formative influence of culture on personality. One course. *Ewing*

180. Current Issues in Anthropology. (SS) Selected topics in methodology, theory, or area. One course. *Staff*

180S. Current Issues in Anthropology. (SS) Same as Cultural Anthropology 180 except instruction is provided in seminar format. One course. *Staff*

184S. Canadian Issues. (SS) Prerequisite: Interdisciplinary Course 98 or consent of instructor. See C-L: Interdisciplinary Course 184S; also C-L: Canadian Studies, Comparative Area Studies, Economics 184S, History 184S, Political Science 184S, and Sociology 184S. One course. *Cahow or Thompson*

193. Independent Study. Directed reading and research. Open only to qualified seniors, with consent of Director of Undergraduate Studies. One course. *Staff*

195S, 196S. Senior Seminar. Consent of Director of Undergraduate Studies required. One course each. *Staff*

For Seniors and Graduates

207S. Anthropology and History. (SS) Recent scholarship that combines anthropology and history, including culture history, ethnohistory, the study of mentalité, structural history, and cultural biography. The value of the concept of culture to history and the concepts of duration and event for anthropology. Prerequisite: major in history, one of the social sciences, or comparative area studies; or graduate standing. C-L: History 210S. One course. *Reddy*

208S. Postcolonial Anthropology. (SS) Review and critique of postcolonial ethnographies and other writings through study of recent work in the history of scientific discovery and the sociology of knowledge. One course. *Starn*

211S. Ethnography of Communication. (SS) History of the mutual influence of linguistics and anthropology leading to the development of ethnography of speaking, ethnoscience, structuralism, and sociolinguistics. Topics vary each semester. Prerequisite: Cultural Anthropology 107 or 119. C-L: Linguistics. One course. *Apte or O'Barr*

214. Postmodernism and the Problem of Representation. (SS) How postmodernism has shaped recent anthropological discourse. Analysis of the premises of postmodernist epistemology and identification of key issues such as truth, authority, and power that are raised by postmodernist critiques of ethnographic representation. Examination of both traditional and experimental ethnographies. One course. *Ewing*

215S. The Anthropology of Women: Theoretical Issues. (SS) Topic to be selected each semester from: gender ideology, women and work, gender inequality, the history of feminist anthropology, or others. C-L: Women's Studies. One course. *Luttrell, Quinn, or Starn*

216S. Gender, Race, and Class. (SS) Gender, race, and class as theoretical constructs and lived experiences. Analytical frameworks include social history, discourse analysis, critical theory, cultural studies, and feminist theories. Consent of instructor required. One course. *Luttrell*

234S. Political Economy of Development: Theories of Change in the Third World. (SS) See C-L: Political Science 234S; also C-L: Comparative Area Studies, History 234S, Interdisciplinary Course 234S, and Sociology 234S. One course. *Staff*

250S. Culture and Discourse. (SS) Theoretical approach to culture and methods for the investigation of culture through analysis of discourse, especially interview texts. Application of this approach and these methods to the study of a domain of American culture. C-L: Linguistics. One course. *Apte, Ewing, O'Barr, Quinn, or Strauss*

251. Cognitive Anthropology. (SS) A cognitively-based theory of culture, its history, justification, substantiation through discourse analysis, application to everyday understanding, feeling and motivation, and implications for the acquisition of culture, cross-cultural variation and cultural universals in human thought. Not open to students who have taken Cultural Anthropology 151. One course. *Quinn or Strauss*

253S. Cross-Cultural Studies of Humor. (SS) Sociocultural basis, nature, scope, and function of humor. One course. *Apte*

257S. Food in Cross-Cultural Perspectives. (SS) The behavioral, institutional, linguistic, religious, and ideological aspects in relation to the production, distribution, and consumption of food within and across cultures. C-L: Comparative Area Studies. One course. *Apte*

258S. Theories of Symbolism. (SS) Influential interpretations of symbols, what they do, and how they do it. The relationship of language to symbolism and symbolism to power. Prerequisites: junior/senior status and at least two courses in cultural anthropology, or graduate standing. One course. *Ewing*

261. Religion: Tradition and Cultural Innovation. (SS) Analysis of anthropological approaches to religion, with an emphasis on how these theories account for conflict and change as they are manifested in religious symbols and ritual action. One course. *Ewing*

262S. Anthropology and Folklore. (SS) Origins, conceptualizations and theoretical orientations, methodology, and subject matter of the discipline of folklore and exploration of its similarities with and differences from sociocultural anthropology. One course. *Apte*

280S, 281S. Seminar in Selected Topics. Special topics in methodology, theory, or area. Consent of instructor required. One course each. *Staff*

282S. Canada. (SS) See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Economics 282S, Interdisciplinary Course 282S, Political Science 282S, and Sociology 282S. One course. *Cahow or Thompson*

COURSES CURRENTLY UNSCHEDULED

94S. Introduction to Cultural Anthropology. (SS)

123. Societies of Mediterranean Europe. (CZ)

132. Anthropology of Peace and War. (SS)

140. The Anthropology of Race. (SS)

141. The Self and the Other. (SS)

- 161. Anthropological Approaches to Religion. (SS)
- 164. Peasantry and Peasant Movements. (SS)
- 173. Revolutions in Latin America. (CZ)
- 201S. Marxism and Anthropology. (SS)
- 219. Language and Social Theory. (SS)
- 239. Culture and Ideology. (SS)
- 252S. American Marriage: A Cultural Approach. (SS)
- 272S. Marxism and Feminism. (SS)

THE MAJOR

Major Requirements. A total of eight courses distributed in the following manner:

—Cultural Anthropology 100.

—At least three courses at the 100-level taught by individuals with actual appointments in Cultural Anthropology, not just cross-listed with Cultural Anthropology. At present, the list of courses fulfilling this requirement consists of Cultural Anthropology 110, 111, 113, 114, 118S, 119, 120, 122, 124S, 126, 132, 135, 139, 141, 143, 145, 151, 155, 162S, 165, 173, 180, 180S, 193, 195S, and 196S.

—At least two 200-level courses from the Cultural Anthropology department's course list.

—Any two additional courses from the Cultural Anthropology department's course list, not more than one below the 100-level.

Suggested Work in Related Disciplines. Related courses in other departments are strongly advised. Each student's advisor will recommend a program of related work to complement the student's concentration and interests in cultural anthropology.

Honors/Distinction. Academic distinction within the Department of Cultural Anthropology will enable the graduating major to graduate with Latin honors. Admission to the honors program requires a 3.3 gpa overall and a 3.3 gpa in the major, both of which must be maintained to graduation. Students are required to complete a thesis which has been judged to be of at least B+ quality. In addition, the student must pass an oral examination on the thesis, which is given on its completion. Credit for independent study is available whether or not the research paper is awarded honors. A typical sequence would be:

—select a research topic;

—form a supervisory committee of two members of the cultural anthropology faculty and one faculty member from outside the department;

—take a senior (honors thesis writing) seminar in either the fall or spring of the senior year;

—complete the research and writing by April 1 and submit that final draft to the supervisory committee;

—schedule the oral defense for some time in early or mid-April;

—defend the thesis in an oral examination given by the supervisory committee. If the committee approves the thesis, it will recommend the level of Latin honors to be awarded. Students who are awarded Latin honors will thereby qualify for graduation with distinction in cultural anthropology.

Dance Program (DAN)

Assistant Professor of the Practice Dickinson, *Director of the Program and Director of Undergraduate Studies*; Artists-in-Residence Childs, Desmond, and Taliaferro; Visiting Associate Professor Sommer; Instructors Davis and Dorrance

A certificate, but not a major, is available in this program.

The Dance Program offers its students the opportunity to study modern dance, ballet, dance history, choreography, repertory, and non-Western dance forms in an environment that challenges the student's intellectual, expressive, and physical capabilities. A balanced integration between the creative/performance and the historical/theoretical aspects of dance is emphasized. Academic courses in dance provide a historical and theoretical foundation for the student's creative work. In turn, the student's participation in dance creation and performance, and the development of technical skill, deepen the student's scholarly appreciation of the medium. With this approach the aim of the program is to develop students who are sensitive physical communicators of the visual art of dance and who are articulate spokespeople for the art form.

Courses in technique and performance (partial credit courses) and theory courses (whole course credit) are offered. Dance theory courses fulfill seminar and the arts and literature area of knowledge requirements. Courses in technique and performance may be repeated for credit. A maximum total of *four* course credits (made up of partial credit courses) in technique and performance courses may count toward the thirty-four courses required for graduation.

The certificate, representing an area of concentration supplementing but not replacing a major, is available to all students in the program who meet the following requirements. To earn the certificate in dance, students take six course credits: one year (equivalent of one course credit) of Dance 81 (Repertory), and five full-credit courses including 101 (Introduction to Dance); either 129S (Dance as a Western Theater Art before 1900) *or* 131S (Modern Dance: History and Theory I) *or* 133 (History of African American Dance); 135S (Dance Composition); and two additional courses in dance at the 100 level or above. The student is expected to attain and/or maintain the high intermediate level of either modern dance or ballet technique.

Students are urged to enroll in at least one summer session with the American Dance Festival. If appropriate to the student's specific course of study, one course credit earned at the American Dance Festival may be counted toward the certificate requirements.

Through the Duke in New York Arts Program, a student has the opportunity in the fall semester of the junior or senior year to pursue the study of dance in New York City. Appropriate courses taken at New York University may fulfill certificate requirements.

Courses in Technique and Performance

60. Beginning Modern Dance I. A movement course exploring modern dance through technique, improvisation, and composition. No previous dance experience necessary. Half course. *Staff*

61. Beginning Modern Dance II. Prerequisite: Dance 60 or equivalent. Half course. *Staff*

62. Intermediate Modern Dance I. Increased complexity of movement sequences and greater emphasis on clarity of expression and quality of performance. Prerequisite: Dance 61 or equivalent. Half course. *Staff*

63. Intermediate Modern Dance II. Continuation of Dance 62. Prerequisite: Dance 62 or equivalent. Half course. *Staff*

64. Advanced Modern Dance. Prerequisite: Dance 63 or equivalent. Half course. *Staff*

68. Ballet Fundamentals. Fundamentals of classical ballet technique concentrating on correct placement and body alignment within the ballet vocabulary. No previous dance experience necessary. Half course. *Dorrance*

69. Elementary Jazz Dance. No previous dance experience required. Half course. *Childs*

70. Elementary/Intermediate Ballet. Barre work concentrating on body alignment and correct placement within the ballet vocabulary followed by center adagio and allegro sequences. Prerequisite: Dance 68 or equivalent. Half course. *Dorrance*

71. Intermediate/Advanced Ballet. Greater complexity of barre and center sequences with increased emphasis on correctness of style and quality of performance. Prerequisites: Dance 70 or equivalent, and consent of instructor. Half course. *Dorrance*

72. Intermediate Jazz Dance. Prerequisite: Dance 69 or equivalent. Half course. *Childs*

79. African Dance Technique. Half course. *Davis*

80. Individual Dance Program. Half course. *Staff*

81. Repertory. The study of choreography and performance through participation in the mounting of a dance work from inception through rehearsal to performance. Consent of instructor required. Variable credit. *Staff*

Theory Courses

75. Introduction to Technical Theater. See C-L: Drama 71. One course. *Fitzmorris*

101. Introduction to Dance. (AL) The many facets of dance, specifically dance as a theatre art. Topics include movement analysis, anthropology of dance, modern dance and ballet traditions, choreographic process, critics and dance criticism, training and life of a dancer, and dance and the other arts. The course format includes lecture, discussion, video analysis, and movement sessions. One course. *Dickinson*

129S. Dance as a Western Theater Art before 1900. (AL) A history of theatrical dance, primarily European, with emphasis on developments that occurred after 1500. Illustrative topics: dance in ancient Greece; the Renaissance dancing master; *ballet d'action*; the romantic ballet; Petipa and classical ballet in Russia. One course. *Dickinson*

130. Inter-Arts: Theory and Practice. (AL) See C-L: Institute of the Arts 130; also C-L: Drama 110. Variable credit. *Staff*

131S. Modern Dance: History and Theory I. (AL) Modern dance, through the philosophy and work of its major artists considered in relation to the other arts and the sociopolitical climate of the period 1890 to 1950. One course. *Desmond or Dickinson*

132S. Modern Dance: History and Theory II. (AL) See 131S, but from 1950 to the present. One course. *Desmond or Dickinson*

133. History of African-American Dance. (AL) The traditional roots of African-American dance, such as jazz and tap, and additional influences including world dance cultures. The most important pioneer and contemporary contributors to African-American dance and their role in its theatrical and concert presentation. C-L: African and Afro-American Studies 133. One course. *Staff*

135S. Dance Composition. (AL) The basic elements of movement (time, space, weight, flow) and their choreographic applications explored through structured improvisation, short movement studies, viewing of videotaped dances, and selected readings. Experimentation with devices for movement manipulation and choreographic forms through longer movement studies. Prerequisite: a beginning level dance technique course (modern, ballet, jazz, or African) or consent of instructor. One course. *Staff*

136S. Advanced Dance Composition. (AL) Continuation of the basic elements of movement, choreographic devices and forms explored in 135S. The use of props, sets, lighting and costuming; the relationship of music to dance. Choreographing and directing ensembles. Prerequisite: Dance 135S or consent of instructor. One course. *Staff*

151. Functional Anatomy for Dancers. (AL) The functional anatomy of the musculoskeletal system (muscles, bones, and joints) as specifically applied to dance technique approached through observation, analysis, and movement exploration. Concepts of efficient use and questions of misuse of the body in motion or at rest. One course. *Staff*

161. Stage Costuming. See C-L: Drama 161. One course. *Staff*

164. Make-up and Masks. See C-L: Drama 164. One course. *Staff*

165. Costume Drawing and Rendering. Prerequisite: Drama 161 or consent of instructor. See C-L: Drama 165. One course. *Staff*

169. Design: Costume, Scene, Lighting. See C-L: Drama 169. One course. *Ma, McAuliffe, and D. Simons*

170. Design and Color. See C-L: Drama 170. One course. *Ma*

177. Lighting. Prerequisites: Drama 71 and consent of instructor. See C-L: Drama 177. One course. *Staff*

178. Advanced Lighting Design. See C-L: Drama 178. One course. *Gallegos*

181. Special Topics. Content to be determined each semester. Consent of instructor required. One course. *Staff*

181S. Special Topics. Content to be determined each semester. Consent of instructor required. One course. *Staff*

182S. Choreography. (AL) Advanced study in dance composition designed to develop the student's personal mode of expression. Prerequisites: Dance 135S, Dance 136S, and consent of instructor. One course. *Childs, Dickinson, or Taliaferro*

186S. Stage Management. See C-L: Drama 186S. One course. *Staff*

188S. The Diaghilev Ballet, 1909-1929. (AL) The Diaghilev Ballet as a focal point for modernist movements in the arts and a revitalizing force for ballet that brought together choreographers Fokine, Nijinsky, Massine, Nijinska; composers Stravinsky, Ravel, Debussy, Satie; artists Bakst, Benois, Picasso, Braque. Prerequisite: junior or senior standing or consent of the instructor. C-L: Institute of the Arts 121S and Interdisciplinary Course 188S. One course. *Dickinson and staff*

189S. Dance Criticism: From Stage to Page. (AL) The theories and practicalities of how to look at and write about dance performance, ranging from ballet and modern dance to Step shows, clubs, and postmodern performance art. One course. *Desmond*

191, 192. Independent Study. Individual intensive research or creative projects. Consent of instructor required. Half or one course. Variable credit. *Staff*

200. Senior Project. (AL) A research paper, project, or program (with appropriate written documentation) under dance faculty supervision. Open only to seniors earning a certificate in dance. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

65. Beginning Improvisation

- 134. Creative Movement for Children
- 163. Costume Construction
- 197. Aesthetics of Twentieth-Century Dance. (AL)
- 198. Sacred Dance. (AL)

Distinguished Professor Courses (DPC)

Distinguished professor courses enable students, regardless of their majors, to study with some of the most outstanding teachers and scholars within the University. The courses often focus on topics of broad intellectual and academic interest beyond the scope of a single discipline. They may count toward the appropriate distributional requirements as indicated.

189S. Building the Brain. (NS) Human brain development; implications of this process for a variety of biological, educational, and social issues. Topics include the organization of the brain into maps and modules; the role of experience in shaping neural connections; the existence of critical periods for learning the development of behavior; and the nature of aging in the brain. Recommended background: Psychology 103, Biology 154, Biology 21L and/or Biology 22L. Open only to juniors and seniors. C-L: Human Development, Neurobiology 189S, Neurosciences, and Psychology 189S. One course. *Purves*

191. Dante's *Inferno*. (AL) A close study of the text in a bilingual edition. Attention to the historical, political, and theological aspects of the poem. Examples of use of some of the cantos by Joyce, Eliot, and Beckett. Consent of instructor required. One course. *Fowlie*

192. French Existentialism: 1940-1960. (CZ) A critical introduction to the chief positions and controversies of French existentialism. Taught in English. One course. *Mudimbe*

194S. Bach: Master of Style. (AL) An approach to the "deepest thinking," the "most desirous of learning" of all the great composers. Works showing his unique ability to assimilate styles: including the *Brandenburg Concertos*, the *Passions*, and the *B minor Mass*. The complete *Well-tempered Clavier* is studied by the class and performed on the harpsichord by instructor. Consent of instructor required. Prerequisite: ability to read music. C-L: Music 171S. One course. *Williams*

195. Proust, *Remembrance of Things Past*. (AL) In the three-volume translation by Kilmartin. The aesthetics of the novel in terms of its structure, characters, and social classes of France. Students who know French will be encouraged to do some of the reading in French. Consent of instructor required. One course. *Fowlie*

196. The French Symbolists and T. S. Eliot. (AL) A study of the poems and theory of Baudelaire, Mallarmé, and Rimbaud. The debt of the symbolists to Poe and their influence on Eliot. Taught in English. Bilingual texts will be used. Consent of instructor required. One course. *Fowlie*

197S. The Family in Christian History. (CZ) Ideas about and practices concerning the family, sexuality, and reproduction, from the first through the twentieth centuries of Christian history. Open to sophomores, juniors, and seniors. Consent of instructor required. C-L: Religion 190S and Women's Studies. One course. *Clark*

198S. The Discovery of the Old World: Utopias Ancient and Modern. (AL) An exploration of utopian literature as it has been generated by voyages of discovery, both ancient and modern. An examination of how such voyages have led to the rediscovery of the old world from the alien perspective of the new, beginning with the voyages of

discovery of Columbus, Thomas More's *Utopia*, Montaigne's *On Cannibals*, Shakespeare's *Tempest*, and John Lawson's *A New Voyage to Carolina* (1708). Ancient utopian literature, including the *Odyssey*, Aristophanes' *Birds*, Plato's *Atlantis*, Euhemerus' *Panachaia*, Iamboulos' *Island of the Sun*, and Lucian's *True History*. One course. *Clay*

199S. The Changing Biosphere: Past, Present, and Future. (NS) Interactions between changing global environments through time. The maintenance, evolution, and extinction of biotic systems, including communities. Special emphasis on the nineteenth, twentieth, and twenty-first centuries. Consent of instructor required. C-L: Biology 199S. One course. *Billings*

202S. What It Means to Be Human. (SS) What natural and humanistic sciences, and also philosophy and theology, have to say about the distinctive character of human beings. Prerequisite: junior or senior standing. One course. *Langford*

222. Reading Milton. (AL) Milton's epic as a way of exploring some of the questions that have recently been asked about the humanities in general and literary studies in particular. Is the reconstruction of a perspective within which older texts can be responsibly read possible? What do you have to "know" in order to read *Paradise Lost*? What do you have to know in order to know what you have to know to read *Paradise Lost*? Obviously, *Paradise Lost* will be the center of the course, but we shall also read others of Milton's works and look into the tight little world of Milton criticism. C-L: English 222. One course. *Fish*

COURSES CURRENTLY UNSCHEDULED

193S. Handel and Bach: Music for Voice. (AL)

204S. Health Care Law and Policy. (SS)

207S. Topics in Psychobiology. (NS)

Drama Program (DRA)

Faculty of the Program: Professor of the Practice Riddell, *Director of the Program*; Professor of the Practice Clum and Assistant Professor of the Practice McAuliffe, *Directors of Undergraduate Studies*; Professor Randall; Professor of the Practice Hobbs; Assistant Professors of the Practice Fitzmorris, Ma, D. Simons, and J. Simons; Artist-in-Residence Gallegos; Adjunct Professor Azenberg; Lecturers El Guindi and Reinholz; Instructors Kundert-Gibbs and Schilling. Affiliated faculty: Professors Alt (Germanic languages), DeNeef (English), Jackson (English), Jameson (Romance studies), A. Patterson (English), Stewart (Romance studies), and Torgovnick (English); Associate Professors Burian (classical studies), Gaines (English), B. Jones (English), and Porter (English); Assistant Professor Moses (English); Research Professor Dorfman (international studies); Adjunct Assistant Professor Hill (English)

A major is available in this program.

The program in drama seeks to educate students in the historical and creative aspects of the theater. Drama courses are designed to give majors a broad background necessary for advanced professional or scholarly work and to offer nonmajors the opportunity to deepen their understanding and appreciation of the theater. Guiding the work of the faculty is the belief that the theater is a collaborative art form that reaches out to other disciplines. Emphasis is placed on classwork, studio projects, and production opportunities. To keep students abreast of the changing nature of theater, resident professionals and visiting artists regularly hold workshops, teach classes, and participate in the production program.

INTRODUCTORY COURSES

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

51. Introduction to Theater. (AL) Aspects of theatrical production. Text analysis. Introductory survey of drama and theater of the last decade. C-L: English 94. One course. *Clum or Riddell*

64. Drama of Greece and Rome. (AL) See C-L: Classical Studies 64. One course. *Burian*

71. Introduction to Technical Theater. Fundamentals of scenic technology: theater space, tools and hardware, lighting equipment, and reading of plans. Laboratory. C-L: Dance 75. One course. *Fitzmorris*

100. Beginning Acting: Theory and Practice. (AL) Introduction to the art of acting, beginning with an exploration of the self and the actor's imagination. Storytelling skills; the actor's vocabulary. Analysis of given circumstances, intention and dramatic structure, based on reading and practice. Improvisation, monologues, and scene work. One course. *Staff*

OTHER UNDERGRADUATE COURSES

101S. Acting: Poetic Realism. (AL) Readings from Ibsen, Chekhov, Strindberg, Williams and/or O'Neill. Analysis of given circumstances, intention and dramatic structure, based on reading and practice. Use of the script as the primary source for actor choices. Prerequisites: Drama 100 and consent of instructor. One course. *Staff*

102S. Acting: Classical Drama. (AL) Introduction to acting verse drama. Emphasis on text analysis and scansion. Prerequisites: Drama 100 and consent of instructor. One course. *Staff*

103S. Acting: Contemporary Drama. (AL) Introduction to acting twentieth-century drama. Examination and development of performance choices. Prerequisites: Drama 100 and consent of instructor. One course. *Staff*

105. Voice and Speech. Vocal production and articulation. Phonetics, control, emotional response, projection, placement, and awareness of regionalisms. Consent of instructor required. One course. *Staff*

107. Movement. Applied body mechanics, tension release, breath, energy flow, relaxation, emotional response, alignment, and physical articulation. Consent of instructor required. One course. *Staff*

110. Inter-Arts: Theory and Practice. (AL) See C-L: Institute of the Arts 130; also C-L: Dance 130. Variable credit. *Staff*

111S. Playwriting I. (AL) Fundamentals of writing for stage and screen. Open to sophomores, juniors, and seniors; recommended for, but not limited to, students who have taken English 100B. Prerequisites: a practical theater course (for example, acting, directing, design, stagecraft) and consent of instructor. C-L: English 107S and Film and Video. One course. *El Guindi*

112S. Playwriting II. (AL) Advanced projects in writing for production. Prerequisites: Drama 111S or English 107S; Drama 99S, 101S, or 181S; and consent of instructor. C-L: English 108S and Film and Video. One course. *El Guindi*

113S. Screenwriting. (AL) Advanced writing projects for feature film. Study of existing scripts and videos, application of techniques. Consent of instructor required. C-L: English 102S and Film and Video. One course. *Staff*

115, 116. Shakespeare. (AL) See C-L: English 143, 144; also C-L: Medieval and Renaissance Studies. One course each. *DeNeef, Gopen, Jones, A. Patterson, Porter, Randall, or Valbuena*

120. Twentieth-Century American Drama. (AL) See C-L: English 162. One course. *Clum*

121. Modern British Drama. (AL) See C-L: English 133. One course. *Clum or Moses*

122. French Comedy. (AL, FL) See C-L: French 151. One course. *Stewart*

123. French Drama of the Twentieth Century. (AL, FL) See C-L: French 162. One course. *Orr or Tufts*

126. French Drama of the Seventeenth Century. (AL, FL) See C-L: French 148; also C-L: Medieval and Renaissance Studies. One course. *Staff*

130. Advanced Theater Techniques. Exploration of ensemble movement and mime, improvisation, group ritual, masks, and performance pieces, eventually culminating with a production (class) created by students and instructor. Not open to students who completed Drama 49S, Group Theater Techniques. Consent of instructor required. One course. *J. Simons*

131S. Film and Video Theory and Practice. (AL) Prerequisite: Drama 65, English 81, or Literature 177. See C-L: English 183S; also C-L: Institute of the Arts 115S and Film and Video. One course. *Staff*

132. Introduction to Film. (AL) See C-L: English 101A; also C-L: Film and Video. One course. *Gaines*

136. Studies in Film History. (AL) See C-L: English 185; also C-L: Film and Video and Literature 187. One course. *Clum, Gaines, Jameson, or Moses*

137. Melodrama and Soap Opera. (AL) See C-L: English 187. One course. *Clum or Gaines*

138. American Film Genres. (AL) See C-L: English 182; also C-L: Film and Video. One course. *Clum, Gaines, or Moses*

141. Production and Internship. Project work that may begin in the freshman year and extend through graduation, including practical involvement in four different areas of Drama Program productions, participation in Drama Program symposia and other program activities, successful execution of drama major guidelines, completion of an approved internship. Offered only on the pass/fail basis. (Drama majors must have completed or be completing concurrently all other drama major requirements). Prerequisite: Drama 71. No credit. *Staff*

145S. Theater Farce. (AL) Farce as a genre in its onstage context. Aristophanes, Plautus, medieval interludes, Shakespeare, Goldoni, Feydeau, Chekhov, Orton, and others. C-L: English 171S. One course. *El Guindi*

148S. Text and Performance. (AL) (London summer program.) See C-L: English 176S. One course. *Staff*

149S. Drama in Performance. (AL) (London summer program.) See C-L: English 134S. One course. *Staff*

151S. Drama and Theater from 1590 to 1700. (AL) Drama and theater in England, France, and Spain from Marlowe to the end of the Restoration. Plays by Shakespeare, Jonson, Webster, Ford, Farquar, Dryden, Wycherly, Congreve, Molière, Racine,

Corneille, deVega, and Calderon. Scene work from each period. C-L: English 174A,S and Literature 173S. One course. *Clum or Randall*

152. World Theater: Realism and Modernisms. (AL) Ibsen, Strindberg, Chekhov, Shaw, Pirandello, Brecht, Lorca, and other leading modern playwrights through 1960. C-L: English 174B and Literature 174. One course. *Clum or Riddell*

154. Shakespeare and the Theater. (AL) A study of ten Shakespearean plays as blueprints for production. Shakespearean production: history and problems. Includes scene work. C-L: English 130. One course. *Clum or Randall*

161. Stage Costuming. Survey of skills and techniques of design and construction. History, textiles, crafts, millinery, and aesthetics. Laboratory. C-L: Dance 161. One course. *Staff*

162. Costume Techniques. Advanced skills and techniques of textures, armor, millinery, quilting. Prerequisite: Drama 161 or consent of instructor. One course. *Staff*

164. Make-up and Masks. Theory and practice. Design and execution. Methods, materials, special problems, and projects. Laboratory. C-L: Dance 164. One course. *Staff*

165. Costume Drawing and Rendering. Fundamentals of representational costume drawing using eye training methods. Prerequisite: Drama 161 or consent of instructor. C-L: Dance 165. One course. *Staff*

169. Design: Costume, Scene, Lighting. Design principles for theater. Presentation of theatrical concepts via drawings and models. Projects prepared for criticism, with emphasis on play analysis, research, sketches, models, and ground plans. Focus on collaborative processes leading to design solutions. C-L: Dance 169. One course. *Ma, McAuliffe, and D. Simons*

170. Design and Color. Concepts of visual design: line, shape, form, space, texture, color, and value as used in two- and three-dimensional design art. Relationship to dramatic concepts. C-L: Dance 170. One course. *Ma*

171. Advanced Stagecraft. Advanced methods and tools of scenery construction. Emphasis on welding, brazing, furniture repair. Laboratory. Prerequisites: Drama 71 and consent of instructor. One course. *Fitzmorris*

172. Scene Design I. Aesthetics and skills of designing scenery for theater. Emphasis on design projects and problem solving. Introduction to drawing and color. Prerequisite: Drama major standing or consent of instructor based on portfolio review. One course. *Ma*

173. Scene Design II. Advanced applications. Prerequisite: Drama 172. One course. *Ma*

175. Advanced Topics in Stagecraft. Problem solving of theater technology. Solutions to problems such as interior theater architectural design, stage elevator systems, and tracking. Prerequisites: Drama 71 and consent of instructor. One course. *Fitzmorris*

177. Lighting. History, fundamentals of electricity, instrumentation, light plots, aesthetics, and design problems. Prerequisites: Drama 71 and consent of instructor. C-L: Dance 177. One course. *Staff*

178. Advanced Lighting Design. Design principles for stage lighting. Emphasis on the aesthetic and practical attributes of light in the controlled environment of theater. C-L: Dance 178. One course. *Gallegos*

181S. Directing: Theory and Practice I. (AL) History, aesthetics, and fundamental techniques of directing. (Drama 51 may be taken concurrently with Drama 181S.) Prerequisites: Drama 51, 99S or 101S, and consent of instructor. One course. *McAuliffe*

182S. Directing: Theory and Practice II. (AL) Advanced application of aesthetics, skills, and theory to performance projects. Prerequisites: Drama 181S and consent of instructor. One course. *McAuliffe*

183S. Directing: Theory and Practice III. (AL) Continuation of Drama 182S, with advanced work in verse drama. Prerequisites: Drama 182S and consent of instructor. One course. *McAuliffe*

185S. Theater Administration. History and principles of running the theater and managing the production. Emphasis on theater organization, theater types (commercial, not-for-profit, regional), and involvement with other entities (unions, investors, philanthropic bodies). One course. *D. Simons*

186S. Stage Management. Fundamentals: methods and procedures of rehearsal and performance organization. Project experience. Preparation of production books, rehearsal and performance logs. In the context of the American professional theater. C-L: Dance 186S. One course. *Staff*

187. Broadway Production. Aspects of producing Broadway shows, from script-selection to final production, and including marketing techniques. Half course. *Azenberg*

191, 192, 193, 194. Independent Study. Individual intensive research or creative projects. Half or one course. Consent of instructor required. Variable credit. *Staff*

195, 196. Special Topics. Illustrative examples: specific writers or other theater artists, media studies, styles, mime, masks, clowns, stage fighting, newspaper criticism, studies of the profession, audition techniques, and theater periods. May be taken more than once. Half course, one course, respectively. *Staff*

195S, 196S. Special Topics. Seminar versions of Drama 195 and 196. May be taken more than once. Half course, one course, respectively. *Staff*

197S. Special Topics in Film. (AL) See C-L: English 189S; also C-L: Film and Video. One course. *Clum, Gaines, or Moses*

220S. German Theater as Anti-Drama. (AL, FL) See C-L: German 233S. One course. *Alt*

225. Renaissance Drama: 1500 to 1642. (AL) See C-L: English 225; also C-L: Medieval and Renaissance Studies. One course. *A. Patterson or Randall*

COURSES CURRENTLY UNSCHEDULED

109S. Acting for Camera

118. Absurdist and Postmodern Drama. (AL)

124S. Contemporary German Theater. (AL, FL)

135. Narrative Film and the Novel. (AL)

139. Television, Technology, and Culture. (AL)

150. The Political Stage. (AL)

163. Costume Construction

166. Costume History. (CZ)

174. Drafting for the Theater

176. Scene Painting

THE MAJOR

The major in drama offers students a grounding in (1) the history of theater and dramatic literature, and (2) the interrelated disciplines of the art of theater, for example, acting, design, directing, playwriting, and technical production. Students completing the major will be prepared for either graduate study, advanced theater training, or entry-level work in the profession.

Prerequisites: Drama 51, 71, and 100S.

Requirements: Drama 151S,* 152,* 181S; 161, 169, or 172; 141; plus three additional 100-level courses in the program.

Ecology

For courses in ecology, see Biology, Environment (School), and Environmental Sciences and Policy Program.

Economics (ECO)

Professor de Marchi, *Chair*; Professor Tower, *Director of Undergraduate Studies*; Professors Bates, Clotfelter, Cook, Gillis, Goodwin, Grabowski, Graham, Havrilesky, Kelley, Kimbrough, Krueger, Ladd, McElroy, Moulin, Naylor, Tauchen, Trembl, Vernon, Viscusi, Wallace, Weintraub, and Yohe; Associate Professors Conrad, Kramer, Leitzel, and Marshall; Assistant Professors Baumgardner, Gentry, Hamilton, McGrattan, Meurer, Parks, Pessino, Swenson, and Yang; Professors Emeriti Blackburn, Bronfenbrenner, Davies, and Kreps; Research Professors Burmeister and Coats; Adjunct Professor Gallant; Adjunct Associate Professor Zarkin; Visiting Assistant Professors Choi, Coleman, and Ramachandran

A major is available in this department.

Economics courses develop the critical and analytical skills essential for understanding economic problems and institutions, in both their contemporary and historical settings. Although no particular vocational or professional goal is emphasized, these courses provide the academic background necessary for positions in industry, for work in many branches of government service, for law school, and for graduate study in business administration, economics, and the social sciences.

Students planning to do graduate work in economics are advised to take as many of the following courses in mathematics (listed in preferential order) as their schedules permit: Mathematics 31, 32, 103, 104, 131, 135, and 136.

1D. National Income and Public Policy. (SS) Basic economic analysis emphasizing current public policy issues. Means of determining the level and rate of growth of aggregate national income and output. Causes of unemployment, inflation, and international payment problems. The effects of monetary policy (money supply and interest rates) and fiscal policy (government expenditures and taxes) on these problems. For freshmen; upperclassmen only by consent of instructor. One course. *Staff*

2D. Competition, Monopoly, and Welfare. (SS) The composition of output and the distribution of income in a market economy. Role of government. Contemporary prob-

*Drama 151S or 152 may be replaced by Drama 148S or Drama 149S, taught during the summer in the London Program.

lems. Topics such as environmental economics, monopoly, unionism, international trade. Comparison of a market economy with other systems of economic organization. Economic problems of developing countries. Open only to freshmen. One course. *Staff*

2S. Competition, Monopoly, and Welfare. (SS) Seminar version of Economics 2D. Open only to freshmen. Consent of instructor required. One course. *Weintraub*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

51D. National Income and Public Policy. (SS) For description see Economics 1D. Open to all students. May be taken before or after Economics 2D or 52D. One course. *Staff*

52D. Competition, Monopoly, and Welfare. (SS) For description see Economics 2D. Open to all students. May be taken before or after Economics 1D or 51D. One course. *Staff*

53. Economics of Contemporary Issues. (SS) Modern economic problems, such as environmental deterioration and urban decay. The market as one of the interrelated subsystems of the social system, from institutionalist, Marxist, and other perspectives in the social sciences. One course. *Staff*

60. Economics of a United Europe. (SS) The impact of common European monetary policy; implications of common welfare standards for the competitiveness of the countries on the periphery, such as Spain and Portugal; unemployment problems and migration issues. Available only in the Duke in Berlin Fall Program. One course. *Bongaerts*

98. Introduction to Canada. (SS) Does not count for economics major requirements. See C-L: Interdisciplinary Course 98; also C-L: Canadian Studies, History 98, Political Science 98, and Sociology 98. One course. *Cahow or Thompson*

108. Economics of War. (SS) Conflict theory, causes and economic consequences of war, military personnel, military-industrial complex, disarmament, and the economy. Prerequisite: Economics 2D or 52D. One course. *Weintraub*

130. The Changing Role of the Market in the Social System. (SS) Comparison of the different perspectives on the role of the market in the social system, from libertarian to Marxian. Application of the tools of analysis of market behavior to seemingly noneconomic problems such as crime and environmental decay. Prerequisites: Economics 1D or 51D, and 2D or 52D. One course. *Havrilesky*

133. The Evolution of the American Economy. (SS) The process of industrialization and modernization in the United States from the pre-Civil War period to the present. Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. One course. *Coats*

134. Japanese Economy and Its History. (SS) Japanese economic development since the end of isolation, in the mid-nineteenth century. Prerequisite: one course in economics or Far Eastern history. One course. *Bronfenbrenner*

139. Introduction to Econometrics. (QR) Data collection, estimation, and hypothesis testing. Use of econometric models for analysis and policy. Prerequisites: Economics 2D or 2S or 52D, Mathematics 32 or equivalent, and statistics. One course. *Marshall, McElroy, Pessino, Tauchen, or Wallace*

140. Comparative Economic Systems. (SS) A strategic analysis of the new economics of the Soviet Union, China, and Eastern Europe as well as the socioeconomic, political systems of the United States, Japan, Sweden, and other capitalistic countries. Prerequisite:

sites: Economics 1D or 51D, and 2D or 2S or 52D. C-L: Comparative Area Studies. One course. *Naylor*

141. Alternative Economic Systems. (SS) Alternatives to traditional capitalistic free-market economic systems including nontraditional systems such as Marxian economics, communism, radical economics, and democratic socialism. Prerequisites: Economics 1D or 51D and Economics 2D or 2S or 52D. One course. *Naylor*

142. Chinese Economy. (SS) Tools of economic analysis applied to the Chinese economy since 1949. Exposition of commune system, agricultural procurement, state enterprise, and industrial price policies in the pre-reform era. Analysis of rural and urban reforms, and their effects on economic efficiency. Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. One course. *Yang*

144. Education, Development, and Growth. (SS) The basic elements of human capital theory and its application to economic growth and development. Topics include human capital investment, life-cycle earnings, impact of education on farm efficiency, migration, national income accounting, and models of endogenous growth. Data from the United States and other countries used to test theoretical implications. Prerequisites: Economics 149, Economics 154, and Statistics 110B. One course. *Yang*

145. The Soviet Economy and Its Collapse. (SS) Historical development and structure of command-administrative system. Gorbachev's perestroika. The transition from plan to market. One course. *Staff*

149. Microeconomic Theory. (SS) Cost and supply considerations in price theory; the demand for factors of production. The allocation of resources in the context of competitive and monopolistic market structures. Not open to students who have had Public Policy Studies 110. Prerequisites: Economics 2D or 2S or 52D, and Mathematics 31. One course. *Baumgardner, Graham, McElroy, Pessino, Tower, Trembl, Vernon, or Wallace*

150. History of Economic Thought. (SS) Approaches to economic problems from Aristotle to Keynes, emphasizing certain models and doctrines—their origins, relevance, and evolution. Readings from Mun, Quesnay, Adam Smith, Malthus, Ricardo, Marx, Walras, Veblen, and Keynes. Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. C-L: Comparative Area Studies. One course. *de Marchi or Goodwin*

151. Adam Smith and the System of Natural Liberty. (SS) The writings of Adam Smith, including close readings of *The Wealth of Nations* and *The Theory of Moral Sentiments*. Focus on the natural and social context of late eighteenth-century economic ideas, connections with earlier and later thinkers, including Quesnay, Ricardo, Mill, and Marx. C-L: Comparative Area Studies. One course. *de Marchi*

152. Mercantile Culture and Art in the Netherlands. (CZ) See C-L: Art 155. One course. *de Marchi and Van Miegroet*

153. Monetary Economics. (SS) The evolution and operations of commercial and central banking and nonbanking financial institutions in the United States, the determination of monetary aggregates and interest rates, the financial impacts of Treasury operations, and the linkages from Federal Reserve actions to price level, employment, economic growth, and balance of payments objectives. Prerequisite: Economics 154. One course. *Havrilesky or Yohe*

154. Aggregate Economics. (SS) Concepts and measurement of national income and expenditures, employment, interest rates, and price levels; the theoretical determination of these aggregates; applications of macroeconomic theory to business cycles and economic growth. Prerequisites: Economics 1D or 51D, 2D or 2S or 52D, and Mathematics 31. One course. *de Marchi, Havrilesky, Kimbrough, Tauchen, Tower, or Yohe*

155S. Labor Economics: Analysis and Measurement. (SS) Labor market equilibria. The demand for labor. The supply of labor: human fertility, human capital, hours of work, and labor force participation. Wage levels and differences. Union and government as labor market factors. Prerequisites: Economics 149, Mathematics 31, and statistics. One course. *Baumgardner or Pessino*

156. Health Economics. (SS) Economic aspects of the production, distribution, and organization of health care services, such as measuring output, structure of markets, demand for services, supply of services, pricing of services, cost of care, financing mechanisms, and their impact on the relevant markets. Prerequisite: Economics 149. One course. *Baumgardner or Sloan*

157S. Business Cycles and Economic Forecasting. (SS) Causes of fluctuations in economic activity and conventional methods of forecasting micro- and macroeconomic variables, using microcomputer programs. Forecasting projects by students. Prerequisites: Economics 149, 154, and statistics. One course. *Yohe*

158. Financial Markets and Investments. (SS) The tools learned in microeconomics, macroeconomics, basic mathematics, and statistics applied to problems in financial economics. A blend of pure economic theory, an investigation of financial data, and practical applications using personal computers. Prerequisites: Economics 149, Economics 154, and a statistics course—preferably Statistics 110B or 210B. One course. *Burmeister*

160. Nonrenewable Resource Economics and Public Policy. (SS) Prerequisite: Economics 149. See C-L: Public Policy Studies 160. One course. *Conrad*

161S. Economics of Slavery in the American South. (SS) Examines how modern economic analysis is helpful in understanding the nature and development of a slave economy, society, and culture. Combines the study of economic development and comparative economic systems. Prerequisite: Economics 149. C-L: African and Afro-American Studies 161S and History 140S. One course. *Coats*

165. American International Economic Policy. (SS) Topics include United States trade policies and protectionism, the North American Free Trade area, trade and economic relations with industrialized countries, policies toward developing countries and multilateral institutions, macroeconomic policy coordination, and relations with Europe. Prerequisites: Economics 1D or 51D and 2D or 2S or 52D. C-L: Public Policy Studies 165. One course. *Krueger*

171. Behavioral and Experimental Economics. (SS) The relationship between actual behavior and economic models. Topics include individual decision-making behavior, game theory, and the role of market institutions. The interaction of economic and psychological theory. Students have the opportunity to participate in, and conduct, economic experiments. Prerequisite: Economics 149 or consent of instructor. One course. *Staff*

173. Economics of Organization and Management. (SS) Coordination and motivation issues within a corporation along with the internal design and dynamics of organizations. Topics include the structure of employment contracts, performance incentives, and the pricing of financial assets. Prerequisite: Economics 149. One course. *Marshall or Meurer*

180. Law and Economics. (SS) An introduction to the economic analysis of legal issues and legal reasoning. Case studies in accident law, product liability, and the value of life. Other topics include contracts, property, affirmative action, civil procedure, and the economics of criminal behavior. Prerequisite: Economics 149. One course. *Viscusi*

181. Corporate Finance. (SS) Major corporate decisions from the perspective of the firm with an emphasis on the interaction of the firm with financial markets: project evaluation for investment, choice between borrowing and issuing stock, dividend policy, organizational form (for example, mergers and acquisitions). Introduction to financial markets: issuing stocks, analyzing financial performance, and options. Prerequisites: Economics 1D or 51D, 2D or 52D; and some statistics recommended. One course. *Coleman or Gentry*

184S. Canadian Issues. (SS) Does not count for economics major requirements. Prerequisite: Interdisciplinary Course 98 or consent of instructor. See C-L: Interdisciplinary Course 184S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 184S, History 184S, Political Science 184S, and Sociology 184S. One course. *Cahow or Thompson*

187. Public Finance. (SS) Economic aspects of the allocative and distributive role of government in the economy, the incidence and efficiency of taxation, the effects of taxation on behavior, and analysis of major government spending programs. Prerequisite: Economics 149. One course. *Gentry*

188. Industrial Organization. (SS) Economic theories of the behavior of firms within industries. Emphasis upon incentives and the role of information when firms are mutually interdependent. Topics include the agency problem, entry, research and development, collusion, and various pricing schemes. Analysis conducted within a number of regulatory environments. Prerequisites: Economics 149 and statistics, or consent of instructor. One course. *Marshall or Meurer*

189. Business and Government. (SS) Public policies which most directly affect the operation of competition in the business world. The economic basis for an evaluation of antitrust policy, public utility regulation, and public enterprise. Prerequisites: Economics 149 and statistics, or consent of instructor. One course. *Grabowski or Vernon*

191, 192. Independent Study. Directed reading and research. Consent of instructor and Director of Undergraduate Studies required. One course each. *Staff*

193, 194. Independent Study. Same as Economics 191, 192, but for seniors. One course each. *Staff*

For Advanced Undergraduates and Graduates

203S. Mathematical Economics. (SS) Selected mathematical tools from symbolic logic, naive set theory, linear algebra, calculus, analysis, and elementary topology applied to the analysis of economic problems. Topics include consumer choice, production, general equilibrium, and growth. Prerequisites: two courses in college calculus and Economics 149. One course. *Graham*

205S. Advanced Monetary Theory and Policy. (SS) The theory of monetary policy from Keynesian, neoclassical and classical perspectives. Public choice and political economy approaches to monetary policy. The term structure interest rates. Portfolio theory. The theory of the financial services firm. Theories of financial regulatory policy. Prerequisites: Economics 153 and Statistics 10D. One course. *Havrilesky*

207. Models of Conflict and Cooperation. (SS) Cooperative and noncooperative game theory with applications to trading, imperfect competition, cost allocation, and voting. Prerequisites: Economics 149 and Mathematics 31. One course. *Moulin*

207S. Models of Conflict and Cooperation. (SS) Seminar version of 207. Prerequisites: Economics 149 and Mathematics 31. One course. *Moulin*

208S. Economics of the Family. (SS) Economic functions of families including home production gains from marriage, the demand for children, marriage and divorce, child support and alimony, labor supplies of women and men, the distribution of resources within families ("rotten kid theorems" and cooperative and noncooperative games). Applications to marriage and divorce law, day care, U.S. welfare policy, mortality, and farm efficiency in developing nations. One course. *McElroy*

212S. Economic Science and Economic Policy. (SS) A historical examination of the impact of economics on public policy; topics vary each semester and have included energy and anti-inflation policy, productivity growth, the Third World, and the Council of Economic Advisers. Consent of instructor required. One course. *Goodwin*

215S. Applied Cost Benefit Analysis. (SS) The principles of economic cost benefit analysis applicable to circumstances in which market valuations do not provide adequate measures of social desirability. Socially relevant prices for labor, capital, energy, materials, foreign exchange, and valuation of public goods. Development of analysis for individual projects, extended to cover economic policies. Prerequisite: Economics 149. One course. *Staff*

216S. Economics of Education. (SS) Topics include investment in human capital, return to and demand for education, the production function for schooling, public expenditures on schools, effectiveness of private and public schools, the distribution of public educational expenditures, public financing of higher education, inflation in college costs, and labor markets for teachers and professors. Emphasis on students' research projects. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Public Policy Studies 216S. One course. *Clotfelter*

218. Macroeconomic Policy. (SS) Does not count for undergraduate economics major requirements. See C-L: Public Policy Studies 218. One course. *Leitzel*

219S. Economic Problems of Underdeveloped Areas. (SS) Analysis of underdeveloped countries with attention to national and international programs designed to accelerate development. Prerequisite: Economics 149 or consent of instructor. C-L: Comparative Area Studies. One course. *Kelley, Krueger, or Naylor*

220S. Computer Modeling for Policy Analysis. (SS) Introduction to the use of computer techniques in economic policy evaluation; policy applications to international economics, public finance and development economics; computer analysis of linearized and nonlinear models. Students required to complete a major modeling project. Prerequisites: Economics 149 and Economics 154. One course. *Tower*

225S. Games and Information. (SS) Non-cooperative game theory with emphasis upon incomplete/imperfect information and incentive contracting. Applications to insurance (deductibles, coinsurance), labor (piece rates, sharecropping, profit sharing), real estate (commission sales), and law (contingent contracts). Prerequisites: Economics 149 and statistics. One course. *Graham*

232. Microeconomics: Policy Applications. (SS) Does not count for undergraduate economics major requirements. See C-L: Public Policy Studies 232. One course. *Conrad or Ladd*

234. Japanese Economy and Its History. (SS) Japanese economic development since the end of isolation, in the mid-nineteenth century. Not open to students who have had Economics 134. Prerequisite: one course in economics or Far Eastern history. One course. *Bronfenbrenner*

239. Introduction to Econometrics. (QR) Data collection, estimation, and hypothesis testing. Use of econometric models for analysis and policy. (Same as Economics 139 but requires additional term paper, not open to students who have taken Economics

139.) Prerequisites: Economics 2D or 2S or 52D and Mathematics 32 or equivalent and Statistics 10D or equivalent. One course. *McElroy, Pessino, Tauchen, or Wallace*

240. Comparative Economic Systems. (SS) Analysis and comparison of basic economic systems; market versus centrally planned economies; decision making, information, property rights (income and control), and incentives. Western industrialized market economies compared with Soviet-type command economies. Analysis of change, reforms, and of economic problems of systems transformation. Not open to students who have taken Economics 140. Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. C-L: Comparative Area Studies. One course. *Trembl*

241. Quantitative Methods. (QR) Various topics in linear algebra, advanced calculus, real analysis, statistics, econometrics, and computer programming, as relevant for Ph.D. level work in economics. Open to undergraduates and Master's degree students considering pursuing a Ph.D. in economics. Consent of instructor required. Prerequisites: Economics 149 and 154; Mathematics 103, 104, or equivalent. One course. *Tauchen*

242. Chinese Economy. (SS) Tools of economic analysis applied to the Chinese economy since 1949. Exposition of commune system, agricultural procurement, state enterprise, and industrial price policies in the pre-reform era. Analysis of rural and urban reforms, and their effects on economic efficiency. (Same as Economics 142 but requires additional paper; not open to students who have taken Economics 142.) Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. One course. *Yang*

243. Econometrics I. (QR) Economic theory and statistics applied to analysis of economic phenomena. Matrix algebra and calculus used to develop methods for multiple regression and statistical inference. Prerequisite: Economics 241, 249, or equivalents. One course. *McElroy, Tauchen, or Wallace*

244. Education, Development, and Growth. (SS) The basic elements of human capital theory and its application to economic growth and development. Topics include human capital investment, life-cycle earnings, impact of education on farm efficiency, migration, national income accounting, and models of endogenous growth. Data from the United States and other countries are used to test theoretical implications. (Same as Economics 144 but requires additional work; not open to students who have taken Economics 144.) Prerequisites: Economics 149, Economics 154, and Statistics 110B. One course. *Yang*

245. Econometrics II. (QR) Asymptotic theory for finite dimensional parametric models. Topics include nonlinear maximum likelihood, nonlinear regression, extremum estimators, aspects of computation, hypothesis testing, and models with limited dependent variables. Prerequisite: Economics 243 or equivalent. C-L: Statistics 265. One course. *Tauchen*

246. Econometrics III. (QR) Advanced topics in econometrics including asymptotic theory, nonparametrics, and specification testing. Prerequisite: Economics 245. C-L: Statistics 266. One course. *Gallant and Tauchen*

247. Applied Econometrics. (QR) Application of current developments in econometric methodology to empirical problems in economics. Emphasis on the conduct of empirical research, including model and hypothesis formulation, testing, and integration of economic and econometric theory. Prerequisite: Economics 243 or equivalent. One course. *McElroy or Wallace*

249. Microeconomics. (SS) Cost and supply considerations in price theory; the demand for factors of production. The allocation of resources in the context of competitive and monopolistic market structures. (Similar to Economics 149 but at a

more advanced level; not open to students who have taken Economics 149.) One course. *Staff*

250S. Modern Economic Thought. (SS) Selective survey of themes in economic thinking since 1936, including the role of empirical work and of formalization. Prerequisites: Economics 149, 154, and Statistics 10D or consent of instructor. One course. *de Marchi or Weintraub*

251S. Regulation of Vice and Substance Abuse. (SS) Prerequisite: Economics 149 or Public Policy Studies 110. See C-L: Public Policy Studies 251S. One course. *Cook*

254. Macroeconomics. (SS) Concepts and measurement of national income and expenditures, employment, interest rates, and price levels; the theoretical determination of these aggregates; applications of macroeconomic theory to business cycles and economic growth. (Similar to Economics 154 but at a more advanced level; not open to students who have taken Economics 154.) One course. *Staff*

258. Financial Markets and Investments. (SS) The tools learned in microeconomics, macroeconomics, basic mathematics, and statistics applied to problems in financial economics. A blend of pure economic theory, an investigation of financial data, and practical applications using personal computers. Not open to students who have had Economics 158. Prerequisites: Economics 149, Economics 154, and a statistics course—preferably Statistics 110 or 210. One course. *Burmeister*

259S. State and Local Public Finance. (SS) Prerequisite: Public Policy Studies 217 or equivalent. See C-L: Public Policy Studies 259S. One course. *Ladd*

260. Economic Policy Analysis of Nonrenewable Resources. (SS) Prerequisite: Economics 149, Public Policy Studies 110, or Public Policy Studies 232. See C-L: Public Policy Studies 260. One course. *Conrad*

261. Evaluation of Public Expenditures. (SS) Not open to students who have taken Economics 285. See C-L: Public Policy Studies 261; also C-L: Environment 272. One course. *Conrad*

262S. Seminar in Applied Project Evaluation. (SS) Prerequisite: Economics 285 or Public Policy Studies 261. See C-L: Public Policy Studies 262S. One course. *Conrad*

265. International Trade and Finance. (SS) Fundamental principles of international economic relations. The economic basis for international specialization and trade, the economic gains from international trade and investment, the balance of payments, international finance, and the international monetary system. Prerequisites: Economics 149 and 154. C-L: Canadian Studies. One course. *Kimbrough, Krueger, and Tower*

266S. Current Issues in International Economics. (SS) Emphasis on individual research projects. Prerequisite: Economics 165, 265, or consent of instructor. One course. *Kimbrough, Krueger, or Tower*

269. Microeconomic Analysis. (SS) The basic tools for using microeconomic analysis to address practical economic problems. Topics include consumption, production, externalities, partial equilibrium, and general equilibrium. Applications drawn from labor markets, public goods, cost/benefit analysis, and optimal taxation. The level of the course is between intermediate microeconomics (Economics 149/249) and the core Ph.D. microeconomics sequence (Economics 301/302). One course. *Yang*

270S. Fundamentals of Political Economy. (SS) See C-L: Political Science 270S. One course. *Aldrich, Bates, or Bianco*

271. Behavioral and Experimental Economics. (SS) The relationship between actual behavior and economic models. Topics include individual decision-making

behavior, game theory, and the role of market institutions. The interaction of economic and psychological theory. Students will have the opportunity to participate in, and conduct, economic experiments. (Same as Economics 171 but requires an additional paper; not open to students who have taken Economics 171.) Prerequisite: Economics 149 or consent of instructor. One course. *Staff*

273. Economics of Organization and Management. (SS) Coordination and motivation issues within a corporation along with the internal design and dynamics of organizations. Topics include the structure of employment contracts, performance incentives, and the pricing of financial assets. (Same as Economics 173 but requires additional paper; not open to students who have taken Economics 173.) Prerequisite: Economics 149. One course. *Marshall or Meurer*

282S. Canada. (SS) See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Interdisciplinary Course 282S, Political Science 282S, and Sociology 282S. One course. *Cahow or Thompson*

286S. Economic Policy-Making in Developing Countries. (SS) See C-L: Public Policy Studies 286S; also C-L: Comparative Area Studies. One course. *Conrad, Gillis, or Ramachandran*

287. Public Finance. (SS) Economic aspects of the allocative and distributive role of government in the economy, the incidence and efficiency of taxation, the effects of taxation on behavior, and analysis of major government spending programs. Not open to students who have had Economics 187. (Taught concurrently with Economics 187 but requires additional graduate-level work.) Prerequisite: Economics 149. One course. *Gentry*

288S. Current Issues in United States Federal Tax Policy. (SS) Evaluation of the equity and efficiency of United States tax policy. Topics include: (1) personal consumption versus income taxation and (2) restructuring the taxation of corporate income. Emphasis on the effects of taxes on savings, investment, and the international economy. Prerequisite: Economics 149 or consent of instructor. One course. *Gentry*

293. Soviet Economic History. (SS) From 1917 through the present. Foundations of the command economy—rejection of markets, central planning, industrialization, collectivization of agriculture; economic reforms and search for economic efficiency. Gorbachev's perestroika and the dissolution of the Soviet Union. C-L: Comparative Area Studies. One course. *Trembl*

294S. Soviet Economic System. (SS) Economic planning and administration in the Soviet Union. Theoretical and applied problems of resource allocation, economic development, and optimal micro decision making in a nonmarket economy. Gorbachev's perestroika, search for a new model, and the collapse of the Soviet system. C-L: Comparative Area Studies. One course. *Trembl*

Honors Seminars (by invitation only)

201S, 202S. Current Issues in Economics. (SS) Economic analysis of such issues as the health care system, crime and punishment, pollution and the environment, the performing arts, welfare, and the energy crisis. Prerequisites: for 201S, Economics 149 and statistics; for 202S, Economics 201S. One course each. *Weintraub*

206S. Regulation and Industrial Economics. (SS) Analysis of industrial competition and performance in industries such as automobiles, telephones, cable TV, airlines, pharmaceuticals, tobacco, and health care services. Analysis of the efficiency of regulation and other public policy programs. Prerequisites: Economics 149 and statistics. One course. *Grabowski*

209S. Economics of Population. (SS) Relationship of population growth to economic development and to natural resource and environmental pressures. Causes and impacts of population change, including economic models of fertility, mortality, marriage, and migration. Prerequisites: Economics 149 and 154. One course. *Kelley*

COURSES CURRENTLY UNSCHEDULED

132. Introduction to Economic History. (SS)

169, 170. Microeconomic Analysis I and II. (SS)

198S. Economics of Regulation. (SS)

211S. Current Problems in Aggregate Supply. (SS)

224S. Economics of the Law. (SS)

231S. Economic Development in Latin America. (SS)

235. The Economics of Crime. (SS)

268. Federal Tax Policy. (SS)

THE MAJOR

Prerequisites. Mathematics 31, Economics 1D or 51D, and Economics 2D or 2S or 52D, and an approved statistics course. The best statistics course for most economics majors is Statistics 110B. (Statistics courses currently acceptable include Psychology 117, Public Policy Studies 112, Sociology 133, and Statistics 110B, 112, 114, 210B, 213, and 215.)

Major Requirements. Economics 149, 154, and any three additional 100- or 200-level courses. Substitution of similar courses in other departments for courses in the economics department will not be permitted.

Honors/Distinction

For graduation with departmental distinction at least one honors seminar and an honors paper are required. Prerequisites for admission to an honors seminar, upon invitation to take such a seminar extended by the Director of the Honors Program (Professor Weintraub), are two of the following courses: Economics 149, 154, and an approved statistics course. For Latin honors by honors project the student must meet the same grade point average requirements as for graduation with distinction, take an approved 200-level course in economics and complete a research paper of quality meriting Latin honors. The proposed program of research must be approved in advance by the faculty sponsor and the Director of the Honors Program. See the section on honors in this bulletin.

Education Program (EDU)

Professor of the Practice Davis, *Chair and Director of Undergraduate Studies*; Professor Page; Associate Professors Ballantyne, Di Bona, and Sawyer; Professors of the Practice Beckum and Carbone; Assistant Professor of the Practice Malone; Adjunct Professor Friedrich; Adjunct Associate Professor Martin; Adjunct Assistant Professors Bryant and Wilson; Adjunct Assistant Professors of the Practice Lattimore and Teasley; Lecturers Bookman and Riggsbee; Part-time Instructors Peete, Rice, and Strobel; Senior Lecturing Fellow Sasson

Students who desire an understanding of the study of education as part of their liberal arts program should elect courses in accordance with their special interests. Selected courses in education may satisfy requirements in the social sciences area of knowledge. Students who expect to teach should confer with an advisor in the program

prior to registration each semester. Students interested in certification to teach in secondary schools should consult Professor Malone, Director of Teacher Preparation. Students interested in certification to teach in elementary schools should consult the elementary schools coordinator, Ms. Riggsbee.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

100. Social and Philosophical Foundations of Education. (SS) Basic features and assumptions, viewpoints, and issues of education in contemporary America. One course. *Carbone or Di Bona*

108S. Teaching Practices in Elementary Language Arts and Content Areas. (SS) Research, theories, and practices of language arts, social studies, science, and mathematics instruction in the elementary school. Introduction to appropriate strategies and methodologies that reflect proven educational practices and research. A planned, sequential field-based experience in a model public school is provided. One course. *Riggsbee*

109S. Elementary Curriculum. Seminar in curriculum development. Principles, practices, and problems of instruction. For student teachers only. One course. *Bryant*

117S. Psychology of Personal and Social Adjustment. (SS) Principles of mental health affecting individual and social adjustments. One course. *Malone*

118. Educational Psychology. (SS) Emotional and cognitive learning in children, youth, and adults. One course. *Ballantyne, Davis, Malone, or Page*

120. Elementary Education: Internship. (SS) Supervised internship in an elementary school, involving full-time teaching. For student teachers only. Pass/fail grading only. Two courses. *Riggsbee*

121. Infancy, Early Childhood, and Educational Programs. (SS) Developmental theories and their practical application in education. Emphasis on parenting and teaching. One course. *Riggsbee*

139. Marxism and Society. (SS) Core course for the Program in Perspectives on Marxism and Society. See C-L: Cultural Anthropology 139; also C-L: Comparative Area Studies, History 186, Interdisciplinary Course 139, and Sociology 139. One course. *Wilson*

140. The Psychology of Work. (SS) Factors affecting career choice and change. One course. *Ballantyne*

149S. Exceptional Children. (SS) Etiology and assessment of major types of exceptionalities, including intellectual abilities, physical or emotional handicaps, and sensorially impaired. Family relationships and treatment programs. One course. *Davis*

155S. Tests and Measurements. (SS) Measuring abilities, achievement, and personality. Analysis, criticism, and construction of tests for admission, classroom, and society. One course. *Page*

170, A-O. Selected Topics. One course. *Staff*

189S. The Teaching of Composition, Grammar, and Literature in Secondary School. Includes field-based experiences with local schools. See C-L: English 118S; also C-L: Linguistics. One course. *Staff*

191, 192. Independent Study. Directed reading and research for juniors. Consent of instructor and Director of Undergraduate Studies required. One course each. *Staff*

193, 194. **Independent Study.** Directed reading and research for seniors. Consent of instructor and Director of Undergraduate Studies required. One course each. *Staff*

For Seniors and Graduates

205, 206. **Selected Topics.** One course each. *Staff*

210S. **Higher Education in Latin America.** (SS) An interdisciplinary and comparative approach to the issues and problems of higher education in the context of contemporary society. One course: *Di Bona*

215S. **Seminar in Secondary School Teaching.** Principles, practices, and problems in secondary school instruction. One course. *Carbone or staff*

216. **Secondary Education: Internship.** Supervised internship in senior high schools involving some full-time teaching. For student teachers only. Two courses. *Bookman, Carbone, Rice, Strobel, or staff*

225. **Teaching of History and the Social Studies.** Evaluation of the objectives, content, materials, and methods in the teaching of history and the social studies. Includes field-based experiences with local schools. One course. *Wilson*

232. **Learning and Living in Families.** Role and function of the family as related to the development and behavior of its members, to gender identification, to parenting, and to interactions among family members. One course. *Ballantyne or Davis*

236S. **Teaching Developmental and Remedial Reading in the Secondary School.** Principles and methods for the development of effective reading and learning strategies in the high school classroom. Includes field-based experiences with local schools. One course. *Malone*

242S. **Group Interactions.** Examination of theoretical issues and processes involved in the dynamics of, and learning in, small groups of children, adolescents, parents, other adults, with attention to problem-oriented groups. One course. *Ballantyne*

246. **Teaching of Mathematics.** Aims, curriculum, and classroom procedure for teaching secondary school mathematics. Includes field-based experiences with local schools. One course. *Bookman*

276. **Teaching of High School Science.** Discussion, lectures, and collateral reading related to such topics as aims, tests, curriculum, classroom and laboratory procedures, field trips, and course and lesson planning for secondary school science. Includes field-based experiences with local schools. One course. *Rice*

COURSES CURRENTLY UNSCHEDULED

103S. **American Educational Theory.** (SS)

168S. **Contemporary Education Criticism.** (SS)

171T, 172T. **Junior-Senior Tutorials**

173, 174. **Clinical Reading Practicum**

211. **Education and the Mass Media.** (SS)

212S. **Pedagogy and Political Economy: A World View.** (SS)

227. **Contemporary Theories of Counseling and Psychotherapy.** (SS)

248. **Practicum in Counseling**

UNIVERSITY PROGRAM FOR PREPARATION FOR TEACHING*

Duke University offers programs to prepare students to become certified teachers in elementary and secondary schools. As students complete requirements of Trinity College and of a selected major they may also fulfill requirements of the approved Teacher Preparation Program and become certified to teach. Certification by the Duke approved program is authorized through the State Board of Education in North Carolina and is reciprocal with most states. A certificate to teach along with an undergraduate degree is required by most public school systems and is recommended by many independent schools.

Brief descriptions of two undergraduate programs based on Bachelor of Arts or Bachelor of Science degrees (secondary school teaching and elementary teaching) are followed by a description of a program for secondary teaching based on a Master of Arts in Teaching degree. The goals of and criteria for admission to any of these programs are available from the respective offices.

Secondary School Teaching (A.B. or B.S. degree)

Students who are majors in the departments of English or mathematics may become eligible to be certified in their fields. Majors in biology, chemistry, geology, or physics may become eligible to be certified to teach high school science. Majors in cultural anthropology, economics, history, political science, psychology, public policy, religion, or sociology are eligible to be certified to teach social studies. Prospective teachers are advised to consult with their major academic advisors and the Director of Teacher Preparation concerning their interest in teaching and in being accepted into the preparation program.

Interested undergraduate students may apply to the Secondary School Teaching Program in the spring of their sophomore year or the fall of their junior year. Students are accepted by competitive criteria into a program which includes education courses with field experiences in schools, and an intensive senior spring semester internship. During the internship students teach high school classes in their respective disciplines under the supervision of an experienced master teacher and a university professor.

Upon completion of the senior year spring internship semester, and upon completion of the four-year Trinity College undergraduate degree, students may apply for certification to teach in their academic field in a secondary school.

Elementary Teaching (A.B. or B.S. degree)

Undergraduate students who have the desire to teach young children (usually kindergarten through grade six) may qualify for a teaching certificate while at Duke in addition to completing any academic major offered by Trinity College. The Elementary Program includes academic course work and an intensive senior fall semester internship.

Interested undergraduate students should apply to the Elementary Program in the fall of the junior year. Students are selected by competitive criteria for participation in an intensive senior fall semester which links together a teaching internship in a model school, seminars, and independent directed research (four course credits). Students selected for the public elementary teaching certificate program are placed as interns with master teachers in a public elementary school and supervised by a Duke professor on a

*Duke University is accredited by the North Carolina Department of Public Instruction and has reciprocal approval for initial certification with most of the fifty states.

one-to-one basis. Duke student interns begin their internship with the master teacher during preservice days before classes for children begin.

Upon completion of the senior year fall semester internship and the four-year Trinity College undergraduate degree, students may apply for elementary teaching certification.

Master of Arts in Teaching (MAT) in Secondary Schools

The Master of Arts in Teaching Program is designed for students who wish to teach their discipline in secondary schools by completing a graduate degree. Entry into the MAT Program is targeted for the second semester of the student's senior year. The normal sequence for MAT course work may begin in the spring semester of the senior year. Courses may not be double-counted toward both the bachelor's and MAT degrees. Additional information is available from the Office of the Dean of the Graduate School. This program is approved for teacher certification by the State Board of Education in North Carolina and is reciprocal with most states.

English (ENG)

Professor Jackson, *Chair*; Professor Butters, *Associate Chair*; Associate Professor Gerber, *Director of Undergraduate Studies*; Professor of the Practice Gopen, *Supervisor of Freshman Instruction and Director of University Writing Program*; Professors Applewhite, Clum, C. Davidson, DeNeef, Fish, Gleckner, F. Lentricchia, A. Patterson, L. Patterson, Price, Randall, Ryals, Sedgwick, B. H. Smith, Strandberg, Tompkins, Torgovnick, and K. Williams; Associate Professors Gaines, Jones, Mellown, Moon, Pope, Porter, Schwartz, and Willis; Assistant Professors Ferraro, Moses, Pfau, and Tetel; Assistant Professors of the Practice Cox, Hillard, and M. Lentricchia; Adjunct Professor A. Davidson; Adjunct Associate Professor Ruderman; Adjunct Assistant Professors Hill, Kennedy, Sasson, and Wittig; Visiting Professor L. Smith; Visiting Assistant Professor Valbuena

A major is available in this department.

WRITING AND LANGUAGE

For courses in composition see below and also University Writing Courses 3, 4, 5, 6, 7, 8, and 12 in the University Writing Program section of this bulletin.

27S. Studies in Nonliterary Topics. May be taken twice. One course. *Staff*

28S. Introduction to Creative Writing. (AL) Consent of instructor required. One course. *Staff*

29. Composition and Language. Credit for advanced placement on the basis of the College Board examination in composition and language. One course.

100A, S. Writing: Fiction. (AL) Instruction in the writing and study of fiction. Recommended for students before they take English 103S, 104S, 110S, 202S, or 203S. Consent of instructor required. One course. *Staff*

100B, S. Writing: Drama. (AL) Instruction in the writing and study of drama. Recommended for students before they take English 102S or 107S. Consent of instructor required. One course. *Staff*

100C, S. Writing: Poetry. (AL) Instruction in the writing and study of poetry. Recommended for students before they take English 105S or 106S. Consent of instructor required. One course. *Staff*

102S. Screenwriting. (AL) Consent of instructor required. See C-L: Drama 113S; also C-L: Film and Video. One course. *Staff*

103S, 104S. Writing: Short Stories. (AL) Class discussion of students' manuscripts, individual conferences with the instructor. Open to sophomores, juniors, and seniors; recommended for, but not limited to, students who have taken English 100A. Consent of instructor required. One course each. *Applewhite, Cox, M. Lentricchia, Pope, Porter, or Price*

105S, 106S. The Writing of Poetry. (AL) Meter, image, tone, and dramatic organization in traditional and modern poems as a basis for original composition. Open to sophomores, juniors, and seniors; recommended for, but not limited to, students who have taken English 100C. Consent of instructor required. One course each. *Applewhite or Pope*

107S. Playwriting I. (AL) Fundamentals of writing for stage and screen. Open to sophomores, juniors, and seniors; recommended for, but not limited to, students who have taken English 100B. Prerequisites: a practical theater course (for example, acting, directing, design, stagecraft) and consent of instructor. C-L: Drama 111S and Film and Video. One course. *El Guindi (drama)*

108S. Playwriting II. (AL) Advanced projects in writing for production. Prerequisites: Drama 111S or English 107S; Drama 99S, 101S, or 181S; and consent of instructor. C-L: Drama 112S and Film and Video. One course. *El Guindi (drama)*

109S. Special Topics in Writing. (AL) Consent of instructor required. One course. *Staff*

110S. Writing: Longer Prose Narrative. (AL) The writing of a novel, novella, or group of short stories. Primarily for juniors and seniors. Consent of instructor required. One course. *Cox, Porter, or Price*

111. Introduction to Linguistics. (SS) See C-L: Cultural Anthropology 107; also C-L: Interdisciplinary Course 111 and Linguistics. One course. *Butters or Tetel*

112. English Historical Linguistics. (SS) Introduction to methods and principles of historical linguistics, as exemplified by the history of the English language from Proto-Indo-European to the present. Not open to students who have taken English 208. C-L: Linguistics. One course. *Butters or Tetel*

115. Present-Day English. (SS) Origins, development, and current structure of English, especially in America. Transformational versus traditional and structural grammar, written versus spoken English, social and regional dialects. Not open to students who have taken English 209. C-L: Linguistics. One course. *Butters*

116A. Scientific Writing. Prerequisite: University Writing Course 4, 5, 6, or 7. See C-L: University Writing Course 112. One course. *Staff*

117A, S. Advanced Composition I. See C-L: University Writing Course 117S. One course. *Staff*

117B, S. Advanced Composition II. Prerequisite: successful completion of English 117A. See C-L: University Writing Course 118S. One course. *Staff*

118S. The Teaching of Composition, Grammar, and Literature in Secondary School. Visits to secondary school English classes, discussion with successful teachers, practice in making presentations, and evaluation of written work and other performance. C-L: Education 189S and Linguistics. One course. *Staff*

119. Current Topics in Linguistics. (SS) May be repeated as topics vary. See C-L: Cultural Anthropology 112; also C-L: Interdisciplinary Course 119 and Linguistics. One course. *Staff*

For Juniors, Seniors, and Graduates

202S. Narrative Writing. (AL) The writing of short stories, memoirs, tales, and other narrations. Readings from ancient and modern narrative. Close discussion of frequent submissions by class members. Consent of instructor required. One course. *Price*

203S. Advanced Narrative Writing. (AL) The writing of extended narrative prose—long stories, novellas, substantive memoirs. Students should be proficient in the writing of short narratives. Consent of instructor required. One course. *Price*

205. Semiotics and Linguistics. (SS) See C-L: Russian 205. One course. *Andrews (Slavic)*

208. History of the English Language. (SS) Introductory survey of the changes in sounds, forms, and vocabulary of the English language from its beginning to the present, with emphasis on the evolution of the language as a medium of literary expression. Not open to students who have taken English 112. C-L: Linguistics and Medieval and Renaissance Studies. One course. *Butters or Tetel*

209. Present-Day English. (SS) A survey of contemporary linguistic theories applied to modern English; designed for students of literature and teachers of English. Not open to students who have taken English 115. C-L: Linguistics. One course. *Butters*

290. Methods of Composition Pedagogy. (SS) A philosophical and practical exploration of developments in the field of composition studies. Cognition, concept formation, psycholinguistics, interpretation, and the making of meaning. Works by Burke, Richards, Kitzhaber, Berlin, Berthoff, Bizzell, Elbow, Corbett, Macrorie, Williams, Coles, and others. One course. *Gopen and Hillard*

INTRODUCTION TO LITERATURE

20. Literature and Composition. Credit for advanced placement on the basis of the College Board examination in literature and composition. One course.

21S. Studies in the Novel. (AL) One course. *Staff*

22S. Studies in Drama. (AL) One course. *Staff*

23S. Studies in the Short Story. (AL) One course. *Staff*

24S. Studies in Poetry. (AL) One course. *Staff*

25S. Studies in the Epic. (AL) One course. *Staff*

26S. Studies in Special Topics. (AL) May be taken twice. One course. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

50S. American Literature Walkabout. An experimental course designed to engage students with literature at the deepest level. The main texts will be *Moby-Dick*, *Beloved*, *The Awakening*, readings from Thoreau, "Song of Myself," and other poems. Approaches will be largely student generated and may include field trips, graphic representation, autobiography, and drama. Emphasis on group interaction, self-discovery, experiential learning. Weekly writing assignments. Pass/fail grading only. One course. *Tompkins*

51, 52. Representative American Writers. (AL) Selections and complete works. 51: Poe, Emerson or Thoreau, Hawthorne, Melville, Whitman, Dickinson, and Twain; not open to students who have taken English 152 or 153. 52: James, Frost or Robinson, Crane or Dreiser, O'Neill, Faulkner, Hemingway, and others. Not open to students who have taken English 153 or 154. One course each. *Staff*

90. Reading Critically: Poetry, Fiction, Drama. (AL) An introduction to the skills of critical reading and the vocabulary of critical analysis by close examination of poetry, fiction, and drama from a range of historical periods. A handbook or comparable guide to critical terms will be assigned. One course. *Staff*

90S. Reading Critically: Poetry, Fiction, Drama. (AL) A seminar version of English 90. One course. *Wittig*

91. Reading Critically: Chaucer, Shakespeare, Milton, Pope. (AL) An introduction to the skills of critical reading and the vocabulary of critical analysis by close examination of the works of Chaucer, Shakespeare (or occasionally Spenser), Milton, and Pope. Focus on the acquisition of critical skills through analyzing the works of authors closely linked with the making of the dominant traditions of English poetry. A handbook or comparable guide to critical terms will be assigned. One course. *Staff*

92. British Literature 1750-1950. (AL) Studies in the literature of Great Britain from the eighteenth century through the modern period. One course. *Staff*

94. Introduction to Theater. (AL) See C-L: Drama 51. One course. *Clum or Riddell*

ENGLISH AND BRITISH LITERATURE

113A. Introduction to Old English. (AL) An introduction to the language of the Anglo-Saxon period (700-1100), with readings in representative prose and poetry. Not open to students who have taken 207A or the equivalent. C-L: Linguistics and Medieval and Renaissance Studies. One course. *Staff*

113B. Old English Literature. (AL) Critical study of Anglo-Saxon prose and poetry, with attention to the historical and cultural context. Not open to students who have taken 207B. Prerequisite: English 113A, 207A, or the equivalent. C-L: Medieval and Renaissance Studies. One course. *Staff*

121. Medieval English Literature to 1500. (AL) The principal forms and examples of English prose, poetry, and drama of the Anglo-Saxon and Middle English periods (excluding Chaucer). In translation. C-L: Medieval and Renaissance Studies. One course. *L. Patterson*

122. Sixteenth-Century English Literature. (AL) Emphasis in poetry on Wyatt, Sidney, Spenser, Raleigh, and Shakespeare; in prose on Sidney and Sir Thomas More; in drama on Marlowe. C-L: Medieval and Renaissance Studies. One course. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*

123. English Literature: 1600 to 1660. (AL) Emphasis in poetry on Jonson and the cavaliers, Donne and the metaphysicals; in drama on Jonson, Tourneur, Webster, and Ford; in prose on character writers, Bacon, Burton, Donne, and Browne. C-L: Medieval and Renaissance Studies. One course. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*

124. English Literature: 1660 to 1800. (AL) Major genres and authors such as Dryden, Congreve, Addison, Swift, Pope, Gray, Johnson, Blake, and Defoe or Fielding. One course. *Jackson*

125. English Literature of the Romantic Period. (AL) Wordsworth, Coleridge, Byron, Shelley, Keats. One course. *Applewhite, Gleckner, Jackson, or Pfau*

126. English Literature: 1832 to 1900. (AL) Major writers and genres, with special emphasis on the Brontës, Dickens, Hardy, Tennyson, Carlyle, Browning, Arnold, and Ruskin. One course. *Ryals or Sedgwick*

127, 128. Twentieth-Century British Literature. (AL) Emphasis on principal writers of fiction, drama, and poetry. 127: usually Conrad, Shaw, Yeats, Wells, Synge, Forster,

Woolf, and Joyce. 128: usually Lawrence, Cary, Huxley, Auden, Greene, Beckett, and Dylan Thomas. One course each. *Mellown, Moses, or Pope*

130. Shakespeare and the Theater. (AL) See C-L: Drama 154. One course. *Clum or Randall*

131. Studies in a Single British Author. (AL) One course. *Staff*

132A. Faith and Fiction in Victorian England. (AL) (Summer program in England.) Not open to students who have taken English 137. See C-L: Religion 186. One course. *Staff*

132B. Atmosphere and Mystery in Twentieth-Century English Fiction. (AL) Not open to students who have taken English 138. See C-L: Religion 187. One course. *Kort (religion)*

132E-132F. S. Nineteenth-Century British Literature. (AL) (Taught in the Oxford summer program.) Two courses. *Staff*

132G-132H. S. Twentieth-Century British Literature. (AL) (Taught in the Oxford summer program.) Two courses. *Staff*

133. Modern British Drama. (AL) O'Casey, Coward, Eliot, Osborne, Pinter, Beckett, Stoppard, and others. C-L: Drama 121. One course. *Clum or Moses*

134S. Drama in Performance. (AL) Drama from the Elizabethan period to the present based on performances offered by the Royal Shakespeare Company, Royal National Theatre, and other theaters in London. Twenty plays will be seen and studied. (London summer program.) C-L: Drama 149S. One course. *Staff*

135. British Poetry of the Twentieth Century. (AL) Changes in poetry and its criticism from the Edwardians. Yeats, Housman, Lawrence, Owen, the Sitwells, Graves, Auden, MacNeice, Dylan Thomas, Hughes, and Larkin. One course. *Mellown, Moses, or Pope*

136. Eighteenth-Century British Novel. (AL) Defoe, Richardson, Fielding, Smollett, and Sterne; the Gothic novel. One course. *Jackson*

137. Nineteenth-Century British Novel. (AL) Scott, Austen, Dickens, Thackeray, Trollope, the Brontës, George Eliot, Meredith, Butler, Hardy, and others. Not open to students who have taken English 132A. One course. *A. Davidson, Moses, Ryals, or Sedgwick*

138. Twentieth-Century British Novel. (AL) Conrad, Lawrence, Forster, Joyce, Woolf, Huxley, Cary, Amis, and Golding. Not open to students who have taken English 132B. One course. *A. Davidson, Mellown, Moses, or Pope*

139S. Special Topics in British Literature. (AL) One course. *Staff*

Major Authors

140, 141. Chaucer. (AL) 140: first two-thirds of his career, especially *Troilus and Criseyde*. 141: *The Canterbury Tales*. C-L: Medieval and Renaissance Studies. One course each. *DeNeef, Gopen, or L. Patterson*

143, 144. Shakespeare. (AL) 143: twelve plays before 1600. 144: usually ten plays after 1600. C-L: Drama 115, 116 and Medieval and Renaissance Studies. One course each. *DeNeef, Gopen, Jones, A. Patterson, Porter, Randall, or Valbuena*

145. Milton. (AL) Poetry and its literary and social background. C-L: Medieval and Renaissance Studies. One course. *Fish, A. Patterson, Price, or Schwartz*

For Juniors, Seniors, and Graduates

207A. Introduction to Old English. (AL) An introduction to the language of the Anglo-Saxon period (700-1100), with readings in representative prose and poetry. Not open to students who have taken 113A or the equivalent. C-L: Linguistics and Medieval and Renaissance Studies. One course. *Staff*

207B. Old English Literature. (AL) Critical study of Anglo-Saxon prose and poetry, with attention to the historical and cultural context. Not open to students who have taken 113B. Prerequisite: English 113A, 207A or the equivalent. C-L: Medieval and Renaissance Studies. One course. *Staff*

212. Middle English Literature: 1100 to 1500. (AL) Selected topics. C-L: Medieval and Renaissance Studies. One course. *L. Patterson*

213, 214. Chaucer. (AL) 213: first two-thirds of his career, especially *Troilus and Criseyde*. 214: *The Canterbury Tales*. C-L: Medieval and Renaissance Studies. One course each. *L. Patterson*

221. Renaissance Prose and Poetry: 1500 to 1660. (AL) Selected topics. C-L: Medieval and Renaissance Studies. One course. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*

222. Reading Milton. (AL) Milton's epic as a way of exploring some of the questions that have recently been asked about the humanities in general and literary studies in particular. Is the reconstruction of a perspective within which older texts can be responsibly read possible? What do you have to "know" in order to read *Paradise Lost*? What do you have to know in order to know what you have to know to read *Paradise Lost*? Obviously, *Paradise Lost* will be the center of the course, but we shall also read others of Milton's works and look into the tight little world of Milton criticism. C-L: Distinguished Professor Course 222. One course. *Fish*

225. Renaissance Drama: 1500 to 1642. (AL) Selected topics. C-L: Drama 225 and Medieval and Renaissance Studies. One course. *A. Patterson or Randall*

235. Restoration and Eighteenth-Century Literature: 1660 to 1800. (AL) Selected topics. One course. *Jackson*

241. Romantic Literature: 1790 to 1830. (AL) Selected topics. One course. *Applewhite, Gleckner, Jackson, or Pfau*

245. Victorian Literature: 1830 to 1900. (AL) Selected topics. One course. *Ryals or Sedgwick*

251. British Literature since 1900. (AL) Selected topics. One course. *F. Lentricchia, Mellown, Moses, or Torgovnick*

AMERICAN LITERATURE

151. American Literature to 1820. (AL) Colonial authors such as Bradford, Taylor, Cotton Mather, Edwards, Byrd, and Franklin, and authors of the early Republic such as Tyler, Freneau, and C. B. Brown. One course. *C. Davidson, Jones, Moon, or Tompkins*

152. American Literature: 1820 to 1860. (AL) Prose and poetry of American romanticism: Emerson, Thoreau, Hawthorne, Poe, Melville, and Whitman. Not open to students who have taken English 51. One course. *C. Davidson, Gerber, Jones, Moon, Tompkins, or K. Williams*

153. American Literature: 1860 to 1915. (AL) Dickinson, Twain, James, the social and philosophical essayists, Crane, Dreiser, Robinson, and Frost. Not open to students who have taken English 52. One course. *C. Davidson, Jones, Moon, or K. Williams*

154. American Literature: 1915 to 1960. (AL) Eliot, Fitzgerald, Hemingway, Faulkner, and others. Not open to students who have taken English 52. One course. *Clum, Ferraro, F. Lentricchia, Moon, Moses, Pope, or Strandberg*

155. Contemporary American Writers. (AL) Novelists and poets prominent since 1960. One course. *Clum, C. Davidson, Ferraro, Moses, or Strandberg*

159. Modern Southern Writers. (AL) Writers who came to maturity following World War I, and their successors: Faulkner, Wolfe, Porter, Tate, Warren, Welty, Taylor, Percy, O'Connor, Dickey, Hurston, Walker, and others. Works analyzed in the historical and cultural context of the region. One course. *Applewhite*

161. Studies in a Single American Author. (AL) One course. *Staff*

162. Twentieth-Century American Drama. (AL) Representative plays by O'Neill, Odets, Williams, Miller, Albee, Lanford Wilson, and others. C-L: Drama 120. One course. *Clum*

163. Twentieth-Century American Poetry. (AL) The classicism of Pound, Eliot, and the Fugitives in relation to the neoromanticism of Stevens, Williams, Crane, and Roethke. Developments during World War II and after: Lowell, Jarrell, Berryman, Dickey, Levertov, and Wright. One course. *Applewhite, Moon, Moses, or Pope*

164, 165. American Fiction. (AL) A survey of the novel and the short story. 164: the nineteenth century; Poe, Hawthorne, Melville, Twain, James, and others. 165: the twentieth century; Hemingway, Faulkner, Fitzgerald, Barth, Pynchon, and others. One course each. *Clum, C. Davidson, Ferraro, Moses, Strandberg, or K. Williams*

167, 168. Afro-American Literature. (AL) 167: oral and written literary traditions from the American colonial period into the nineteenth century, including the spiritual as lyric poetry and the slave narrative as autobiography. 168: the late nineteenth and the twentieth centuries, Paul Laurence Dunbar to Cyrus Colter. C-L: African and Afro-American Studies 173, 174. One course each. *K. Williams*

169S. Special Topics in American Literature. (AL) One course. *Staff*

For Juniors, Seniors, and Graduates

263. American Literature to 1865. (AL) Selected topics. One course. *C. Davidson, Jones, Moon, or Tompkins*

267. American Literature: 1865 to 1915. (AL) Selected topics. One course. *C. Davidson, Tompkins, or K. Williams*

269. American Women Writers. (AL) Selected topics. C-L: Women's Studies. One course. *C. Davidson, Pope, or Tompkins*

275. American Literature since 1915. (AL) Selected topics. One course. *Ferraro, F. Lentricchia, Pope, or Strandberg*

GENRE, CRITICISM, AND WORLD LITERATURE

170. Studies in Genre. (AL) One course. *Staff*

171S. Theater Farce. (AL) See C-L: Drama 145S. One course. *El Guindi (drama)*

172. Literary Theory. (AL) Major works and theoretical issues in the history of literary criticism. One course. *Staff*

173. Legend and Literature. (AL) Classical, Celtic, and/or Germanic legends and their places in later literature. Special attention to monsters in literature and to Arthurian material. One course. *L. Patterson or Torgovnick*

174A. S. Drama and Theater from 1590 to 1700. (AL) See C-L: Drama 151S; also C-L: Literature 173S. One course. *Clum or Randall*

174B. World Theater: Realism and Modernisms. (AL) See C-L: Drama 152; also C-L: Literature 174. One course. *Clum or Riddell*

175. Literary Approaches to the Bible. (AL) Selected books of both Testaments, emphasizing narrative strategies, literary contexts, and Biblical genres: primeval myth, patriarchal history, prophecy, and apocalyptic. One course. *Schwartz*

176S. Text and Performance. (AL) The stages of realization of a play or musical from the script to the production, focusing on productions in London. Aspects of theatrical performance and production through backstage tours, scene work, discussions and workshops with theater practitioners, observations of theater at work, and supervised projects. (London summer program.) C-L: Drama 148S. One course. *Staff*

177. Third World and Postcolonial Fiction. (AL) Comparative study of representative contemporary fiction from Africa, India, the Middle East, Australia, New Zealand, Latin America, and the Caribbean, each within its appropriate cultural, historical, and political context. All readings in English. One course. *Moses*

178. Literature and the Other Arts. (AL) Selected topics in the study of the interrelation of literature and other art forms, such as music and painting. One course. *Staff*

179S. Special Topics in a Literary Genre. (AL) One course. *Staff*

180. Writings in the Rural Tradition: From the Caribbean to the American South. (AL) See C-L: Literature 180; also C-L: African and Afro-American Studies 180 and Comparative Area Studies. One course. *Willis*

184. Literature and Sexualities. (AL) American and British representations of sexual identities and same-sex desire, ranging from the proliferation of homo-/heterosexual discourses in the late nineteenth century to literature about AIDS in contemporary mass media. Whitman, Wilde, Stein, Hall, Forster, Lorde, Moraga, Watney, and others. One course. *Clum or Moon*

186A, S. Canadian Literature in English. (AL) Eighteenth century to the present. Emphasis on the twentieth century and on novels by Hugh MacLennan, Margaret Laurence, Mordecai Richler, Margaret Atwood, Rudy Wiebe, and others. C-L: Canadian Studies and Comparative Area Studies. One course. *A. Davidson*

186B, S. Canadian Theater. (AL) A survey of Canadian drama. C-L: Canadian Studies. One course. *Staff*

For Juniors, Seniors, and Graduates

281. Studies in Genre. (AL) History, criticism, and theory of literary genres such as the novel, pastoral, epic, and drama. One course. *Staff*

285. Major Texts in the History of Literary Criticism. (AL) A survey of major critical writings from Aristotle to the present. One course. *Staff*

288. Special Topics. (AL) Subjects, areas, or themes that cut across historical eras, several national literatures, or genres. One course. *Staff*

289. The Theory of the Novel. (AL) Major issues in the history and theory of the novel. One course. *Moses or Torgovnick*

CULTURAL STUDIES

101A. Introduction to Film. (AL) Basic film theory and history of motion picture technology. Introduction to experimental, documentary, and narrative forms of Third

World, European, and United States cinemas. Economics and aesthetics. C-L: Drama 132 and Film and Video. One course. *Gaines*

101B. Introduction to Cultural Studies. (AL) Basic theoretical approaches to high and low culture—Bourdieu and Adorno, the Frankfurt School and the Birmingham Center for Contemporary Cultural Studies; Third World and feminist approaches; the avant-garde and subcultural resistance. Analysis of sport and leisure, film and photography, law and the arts, popular and classical music, painting and advertising imagery. C-L: Film and Video and Literature 102. One course. *Gaines, Radway, Surin (religion), Tompkins, or Willis*

120. Advertising and Society. (SS) See C-L: Cultural Anthropology 110; also C-L: Film and Video, Sociology 160, and Women's Studies. One course. *Luttrell, O'Barr, J. Smith, or Wilson*

156. History of Mass Culture in the United States. (AL) The formation of American popular culture in different historical periods. Cultural forms including music, movies, fashion, and leisure. C-L: Literature 156. One course. *Gaines, Radway (literature), Tompkins, or Willis*

157, 158. American Literature and Culture. (AL) Relationship of literature to the other arts, American intellectual history, religion, science, technology, and architecture. 157: to the Civil War. 158: from the Civil War to 1960. One course each. *K. Williams*

181. Psychoanalysis, Literature, and Film. (AL) See C-L: Literature 185; also C-L: Comparative Area Studies, Film and Video, and Women's Studies. One course. *Gaines*

182. American Film Genres. (AL) Introduction to study of popular film and television as narrative form and industrial product. Overview of the musical, comedy, western, and gangster genre. Analysis of film stars, history of film technology, and study of audience. C-L: Drama 138 and Film and Video. One course. *Clum, Gaines, or Tompkins*

183S. Film and Video Theory and Practice. (AL) Film and video production in conjunction with comparative history and theory of these technologies. Students produce works in basic Super 8 mm, 16 mm, and small format video production. Prerequisite: Drama 65, English 81, or Literature 177. C-L: Institute of the Arts 115S, Drama 131S, and Film and Video. One course. *Staff*

185. Studies in Film History. (AL) Close examination of a particular issue, period, national cinema, or technological development. C-L: Drama 136, Film and Video, and Literature 187. One course. *Clum, Gaines, or Jameson (literature)*

187. Melodrama and Soap Opera. (AL) History of melodrama from Victorian theatrical production to television soap opera. Close study of popular women's fiction, silent cinema, the thirties and forties woman's picture, and fifties technicolor melodrama. C-L: Drama 137, Film and Video, and Women's Studies. One course. *Clum or Gaines*

189S. Special Topics in Film. (AL) A major genre, period, or director. Prerequisite: Drama 65 or English 81. C-L: Drama 197S and Film and Video. One course. *Clum or Gaines*

284. Contemporary Film Theory. (AL) Post-1968 film theory—Brechtian aesthetics, cinema semiotics, psychoanalytic film theory, technology, feminist theory, and Third World cinema. One course. *Gaines*

INDEPENDENT STUDY

191, 192, 193, 194. Independent Study. Directed reading and research. Consent of both the instructor and the Director of Undergraduate Studies required. Half or one course each. Variable credit. *Staff*

195T. Tutorial. Directed reading and research. Students should consult the Director of Undergraduate Studies as early as possible in the preceding term. One course. *Staff*

197S, 198S. Honors Program Sequence. See *Distinction* and Honors under THE MAJOR. One course each. *Staff*

COURSES CURRENTLY UNSCHEDULED

188. Narrative Film and the Novel. (AL)

190. Television, Technology, and Culture. (AL)

THE MAJOR

For students matriculating in the fall 1992 semester and thereafter:

Basic Requirement. One course from the following list of introductory courses: English 90, 90S, or 91. Except by written permission of the Director of Undergraduate Studies, the course must be taken in the first term after the major has been declared (unless it has been taken earlier). It may be taken concurrently with advanced courses.

Major Requirements. Eight or more courses at the 100- or 200-level, which are to be organized into a coherent plan of study approved by the student's advisor. The courses must include: (a) one of the following major author courses—Chaucer (140, 141, 213, 214), Shakespeare (143, 144), or Milton (145, 222); (b) two courses in British literature before 1900 (including at least one before 1800 in addition to the course taken to satisfy the major author requirement); (c) one 100-level seminar. Recommended, but not required: students planning to enter graduate study in English or American literature should plan to take at least two additional 100-level (or 200-level) courses in British literature before 1900, including at least one more before 1800.

For students who matriculated before the fall 1992 semester:

Students may satisfy the requirements listed above for those matriculating in the fall 1992 semester and thereafter or they may satisfy the requirements as published in the Bulletin for the year that they matriculated.

Foreign Languages

The department recommends that students majoring in English complete at least two years of college-level study, or the equivalent, of a foreign language. Students contemplating graduate work in English should note that many master's programs require examination in one foreign language and that doctoral programs commonly require examination in two. Students interested in linguistics are strongly urged to study at least one non-Indo-European language.

Teacher Certification

Each year a number of Duke English majors earn certificates as secondary school teachers. While licensed by the state of North Carolina, such majors are essentially certified for other states as well. Such training is urged also for those who consider private-school teaching since most private or parochial schools, other things being equal, would prefer the experienced and trained candidate. Such licensing may be gained as part of the English major and is not as time consuming as sometimes believed. Candidates should have a solid background in both American and British literature. Also

helpful are courses in composition, drama, and speech. Among the requirements are an appropriate course in language and several courses in education.

The last semester of the senior year is devoted to the student-teaching block, including two special, accelerated courses and ten weeks of full-time teaching and observation in the schools, working with a selected certified teacher and with Duke faculty. This experience leads to an English-teaching certificate to accompany the bachelor's degree.

Anyone considering secondary school English teaching should confer with Professor Malone in the Program in Education as soon as possible.

Honors/Distinction

The graduation with distinction program is designed for the department's best and most serious students who are willing to make a sustained commitment to the distinction project. The program consists of two seminars—English 197S and 198S—taken in the fall and spring semesters of the senior year.

English 197S varies in content and format according to the interests of the instructor and students, but it will normally include attention to issues of literary interpretation and to the principles of sustained research. It also provides a forum in which to discuss the selection and focusing of thesis topics, preliminary research and organization, and the writing of part of the thesis. English 198S will involve substantial independent work towards completing the distinction thesis, with some seminar meetings and regular conferences with the instructor. The distinction thesis can be a critical paper or an equivalent piece of other research (for example, in linguistics) or creative writing. The department's distinction/honors committee will evaluate the theses and award distinction. A student who has done satisfactory work in the seminars but whose thesis is denied distinction will receive graded credit for English 197S and 198S, but not distinction. Theses awarded distinction will be bound and deposited in Perkins Library.

Students interested in distinction must apply to the department's committee by February 1 of the junior year. Applicants normally must have completed at least three courses in English (not including a University Writing Course) and must have a minimum B+ average in their English courses. In addition, they must submit a writing sample and solicit a written recommendation from one of their instructors (in courses other than the University Writing Course).

Students who matriculated after May 1988 and who successfully complete the distinction program as detailed above may be eligible as well for graduation with Latin honors. To be awarded Latin honors at graduation, a student must have maintained a 3.5 grade point average in English and a 3.3 grade point average overall and written a distinction thesis of exceptional merit, as evaluated by the department's distinction/honors committee.

School of the Environment

The professional school courses listed below are described fully in the *Bulletin of Duke University: School of the Environment*. They are open to undergraduates by consent of the instructor; they do not count for area of knowledge distribution requirements.

Students who are preparing for professional careers in natural resources and the environment should refer to the section on undergraduate-professional combination programs and the section Environmental Sciences and Policy Program in this bulletin.

191, 192. Independent Study. Open to qualified juniors and seniors with consent of the student's major advisor and the instructor. Credit to be arranged. *Staff*

200. Integrated Case Studies. Prerequisite: consent of the dean of the School of the Environment. Credit to be arranged. *Staff*

201. Forest Resources Field Skills. Half course. *Davison and Richter*

204. Forest Inventory, Growth, and Yield. One course. *Davison*

205, 205L. Ecological Management of Forest Systems (Silviculture). One course. *Oren*

- 207, 207L. Forest Pest Management. One course. *Stambaugh*
- 211L. Applied Ecology and Ecosystem Management. One course. *Richardson*
212. Environmental Toxicology. Prerequisites: organic chemistry and vertebrate physiology or consent of instructor. One course. *Di Giulio*
213. Forest Ecosystems. One course. *Richter*
215. Environmental Physiology. One course. *Di Giulio and Oren*
216. Applied Population Ecology. Prerequisites: introductory statistics, calculus, and computer programming, or consent of instructor. One course. *Maguire*
217. Tropical Ecology. Prerequisite: a course in general ecology. C-L: Biology 215. One course. *Terborgh*
218. Barrier Island Ecology. (Given at Beaufort.) Prerequisite: course in general ecology. C-L: Biology 218 and Marine Sciences. One and one-half courses. *Staff*
219. Marine Ecology. (Given at Beaufort.) Prerequisites: none; suggested—introductory ecology, invertebrate zoology, or marine botany. C-L: Biology 203L and Marine Sciences. One and one-half courses. *Gerhart*
220. Vegetation Management in Urban Ecosystems. One course. *Stambaugh*
221. Soil Resources. One course. *Richter*
222. Coastal Processes. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Geology 201 and Marine Sciences. Half course. *Howd*
- 230L. Weather and Climate. One course. *Knoerr*
232. Microclimatology. C-L: Biology 232. One course. *Knoerr*
- 234L. Watershed Hydrology. One course. *Staff*
235. Air Quality Management. One course. *Vandenberg*
236. Water Quality Management. One course. *Reckhow*
238. Hydrologic Transport Processes. Prerequisites: Environment 234, 242, or equivalent and familiarity with calculus. One course. *Staff*
242. Environmental Chemistry. C-L: Civil and Environmental Engineering 242. One course. *Faust*
243. Environmental Biochemistry. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Cell Biology 243 and Marine Sciences. One course. *Bonaventura and Brouwer*
244. Cellular and Molecular Research Techniques. (Given at Beaufort.) C-L: Cell Biology 244 and Marine Sciences. One course. *Bonaventura and Brouwer*
251. Statistics and Data Analysis in Biological Science. C-L: Statistics 210B. One course. *Staff*
- 252L. Techniques in Environmental Data Analysis. Prerequisites: Mathematics 31 and 32. C-L: Geology 222L. One course. *Howd*
261. Remote Sensing for Resource Management. One course. *Davison*
- 270L. Resource and Environmental Economics. Prerequisite: introductory course in economics or consent of instructor. C-L: Public Policy Studies 272L. One course. *Kramer*
272. Evaluation of Public Expenditures. C-L: Economics 261 and Public Policy Studies 261. One course. *Conrad*
274. Resource and Environmental Policy. Prerequisite: Environment 270L or consent of instructor. C-L: Public Policy Studies 274. *Healy and Kramer*
277. Conservation and Sustainable Development I: Concepts and Methods. One course. *Staff*
278. Conservation and Sustainable Development II: Integrated Problem Solving. One course. *Staff*
- 282S. Environmental Ethics. Consent of instructor required. C-L: Philosophy 289S. One course. *Cooper*
285. Land Use Principles and Policy. C-L: Public Policy Studies 285. One course. *Healy*
290. Physical Oceanography. Prerequisites: Mathematics 31 and 32 or consent of instructor. One course. *Lozier*
- 291S. Geological Oceanography. Not open to students who have taken Geology 206S. (Given at Beaufort.) C-L: Geology 205S and Marine Sciences. One course. *Johnson*
- 292L. Biological Oceanography. One course (spring); one and one-half courses (summer). (Given at Beaufort.) Prerequisites: Biology 21L, 22L. C-L: Biology 114L and Marine Sciences. *Ramus or staff*
293. Analysis of Ocean Ecosystems. (Given at Beaufort.) Prerequisite: one year of biology, one year of chemistry, or consent of instructor. C-L: Biology 123 and Marine Sciences. One course. *Barber*
- 294L. Marine Communities. (Given at Beaufort.) Prerequisites: Biology 21L, 22L; and Mathematics 31. C-L: Biology 169L and Marine Sciences. One course. *Gerhart*
- 295L. Marine Invertebrate Zoology. (Given at Beaufort.) Not open to students who have taken Biology 274L. Prerequisite: introductory biology (Biology 21L, 22L.) C-L: Biology 176L and Marine Sciences. One and one-half courses. *Kirby-Smith*
- 296L. Benthic Marine Algae. (Given at Beaufort.) Prerequisite: introductory biology; plant diversity recommended. C-L: Biology 219L and Marine Sciences. One course. *Schneider (visiting summer faculty)*
- 297L. Biology of Marine Invertebrates. (Given at Beaufort.) Not open to undergraduate students who have taken Biology 176L. Prerequisite: Biology 21L, 22L or equivalents. C-L: Biology 274L and Marine Sciences. One and one-half courses. *Staff*

COURSES CURRENTLY UNSCHEDULED

- 210, 210L. Forest Pathology

Environmental Sciences and Policy Program

Professor Kramer, *Director*

A major is available in this program.

The undergraduate major in environmental sciences and policy is offered within the Bachelor of Arts degree to students interested in the interdisciplinary study of environmental issues. The major permits students to combine studies in the natural sciences and engineering with courses in social sciences and humanities around general focus areas and themes. This major is specifically designed for students with career objectives such as environmental law, policy, management, or planning that require in-depth understanding of environmental issues that cross traditional disciplinary boundaries.

Elective courses for the major are taught by more than sixty Duke professors in twenty cooperating departments and schools. The prerequisites for this major stress a firm foundation in basic natural and social science areas. An introductory core course focuses on local, regional, and global case histories from the perspective of an interdisciplinary team of faculty. Upper-level courses are selected in consultation with advisors to match a specific environmental theme or career objective. The upper-level curriculum includes a course in probability and statistics, an upper-level seminar, and an independent study, field experience, or internship. At least two courses in the upper-level curriculum must be selected from approved lists in each of the social sciences/humanities and sciences/engineering. The program is administered by its director and an advisory committee representing the various areas and cooperating departments.

Advising: Advisors are assigned based on students' general areas of interest. Students present a proposed plan of study to their advisors that emphasizes the connections among their courses. This proposal is normally completed by the end of the sophomore year. The program encourages close relationships between faculty and students with convergent interests.

Independent Study, Internship, or Field Experience. All students in the program will complete either an independent study, an internship, or a field experience related to their proposed course of study. The director's office, in collaboration with Duke's Career Development and Counseling Office, maintains a file of approved internships. Field experiences may include a semester or summer session at the Duke University Marine Laboratory, one of several approved study abroad programs, or studies at over thirty field laboratories.

Grants and Awards. Grants and awards are administered through the office of the Environmental Sciences and Policy Program. These include support for independent studies, internships, and field studies.

THE MAJOR

Corequisites. The following courses or their equivalents (for example, Advanced Placement credit) are required. Approval to substitute courses taken at other universities must be obtained from the Director of Undergraduate Studies in the department offering the course. Some of these courses are prerequisite to some upper-level courses in this major.

- Biology 21L. Introduction to Organismal and Environmental Biology
- Biology 22L. Introduction to Cellular and Developmental Biology
- Chemistry 11L and 12L. Principles of Chemistry, or Chemistry 23L. Advanced General Chemistry
- Economics 2D or 52D. Competition, Monopoly, and Welfare
- Geology 41. Introduction to Geology
- Political Science 145. Political Analysis for Public Policy-Making (or Public Policy Studies 114)
- Mathematics 31 and 32. Introductory Calculus I and II

Major Requirements.

1. Introductory Core Course: Environment 101. (SS) Introduction to Environmental Sciences and Policy. Application of basic principles of natural science, resource policy and economics, engineering, and ethics to local, regional, and global environmental issues. Not open to first-year students.
2. Probability and Statistics. One course from an approved list dealing with statistical inference and probability theory. Approved courses include:
 - Political Science 138. Quantitative Political Analysis
 - Public Policy Studies 112. Statistics and Public Policy
 - Psychology 117. Statistical Methods
 - Statistics 110. Statistics and Data Analysis in the Social Sciences
 - Statistics 112. Introduction to Applied Statistics
 - Sociology 133. Statistical Methods
 - Environment 251. Natural Resources Data Analysis
3. Focused Study. Six upper-level courses proposed by students in consultation with their advisors to fit a particular theme or career objective. At least two of these courses must be selected from approved lists in each of the social sciences/humanities and sciences/engineering. These lists are available from the Director of Undergraduate Studies of the program. One course must be an upper-level seminar or small-group learning experience.
4. Independent Study/Internship/Field Experience. Students will complete an approved independent study, internship, or field experience which may or may not include course credit toward upper-level requirements. See the Director of Undergraduate Studies for an approved list of courses.

(Note: Courses in a major may count toward only two areas of knowledge for the general studies requirement of the curriculum. Students may not use more than six professional school credits toward the Bachelor of Arts degree.)

Honors. A program for graduation with distinction in environmental sciences and policy is available. See the section on honors in this bulletin. The Director of Undergraduate Studies can provide more details.

Evolutionary Biology

See Biology.

Film and Video Program

Associate Professor Gaines, *Director*

A certificate, but not a major, is available in this program.

The Program in Film and Video is an interdisciplinary course of study which introduces students to the critical analysis of communications technologies: film, photography, and television. Practical production experience is also available through course work and internships. Courses in this area are offered through ten different academic departments and programs and taught by twenty faculty members. The program also sponsors speakers, video art screenings, and exhibits in cooperation with the Center for Documentary Studies, the Institute of the Arts, the Center for International Studies, the University Art Museum, the Literature Program, Asian and African Languages and Literature, and the Mary Lou Williams cultural center. Visiting independent filmmakers are brought to campus under the auspices of the Film and Video Program in conjunction with Screen/Society and Freewater exhibitions.

Students working toward a certificate in film and video declare a major in an academic department. To qualify for the certificate, students take five courses from the approved list published in this bulletin. One of these courses must be an introductory

course selected from those listed below. Program courses are described under the listings of the various departments.

Introductory Courses

Cultural Anthropology 110. Advertising and Society. C-L: English 120, Sociology 160, and Women's Studies. *Luttrell, W. O'Barr, Smith, or Wilson*

English 101A. Introduction to Film. C-L: Drama 65. *Gaines*

English 101B. Introduction to Cultural Studies. C-L: Literature 102. *Gaines, Radway, Surin, Tompkins, or Willis*

English 182. American Film Genres. C-L: Drama 138. *Clum, Gaines, or Tompkins*

Art and Art History

165. Photography. *Noland*

Institute of the Arts

110S. Video and Performance. *Desmond*

Cultural Anthropology

118S. The Language of Advertising. C-L: Linguistics. *W. O'Barr*

Drama

111S. Playwriting I. C-L: English 107S. *El Guindi*

112S. Playwriting II. C-L: English 108S. *El Guindi*

113S. Screenwriting. *Staff*

English

101A. Introduction to Film. C-L: Drama 65. *Gaines*

101B. Introduction to Cultural Studies. C-L: Literature 102. *Gaines, Radway, Surin, Tompkins, or Willis*

156. History of Mass Culture in the United States. C-L: Literature 156. *Gaines, Radway, or Willis*

182. American Film Genres. C-L: Drama 138. *Clum, Gaines, or Tompkins*

183S. Film and Video Theory and Practice. C-L: Institute of the Arts 115S and Drama 131S. *Staff*

185. Studies in Film History. C-L: Drama 136 and Literature 187. *Clum, Gaines, or Jameson*

187. Melodrama and Soap Opera. C-L: Drama 137 and Women's Studies. *Clum or Gaines*

189S. Special Topics in Film. C-L: Drama 197S. *Clum or Gaines*

History

104B. A Survey of Latin American History through Film. *TePaske*

Literature

25A. Third World Novel and Film. *Staff*

30. Special Topics in National Cinema. C-L: Comparative Area Studies. *Staff*

31. Special Topics in Hispanic Cinema. *Staff*

146. The Canadian Image: Cultural Production in French and English Canada. C-L: Canadian Studies and Comparative Area Studies. *A. Davidson*

177. Film Theory. C-L: Women's Studies. *Gaines*

185. Psychoanalysis, Literature, and Film. C-L: Comparative Area Studies, English 181, and Women's Studies. *Gaines*

186. Sexualities in Film and Video. *Clum, Gaines, or Moon*

Political Science

153, 154. Politics and the Media of Mass Communication. *Paletz*

203S. Issues and Problems in Politics and the Media in the United States. *Paletz*

219S. Film and Politics. *Paletz*

Public Policy Studies

154S. Free Press and Public Policy. *Stevens*

163S. Telecommunications Policy and Regulation. *Prak*

176S. American Communities: A Photographic Approach. C-L: Art 118S. *Harris*

180S. Writing for the Media. *Eudy or Reid*

240S. Analyzing the News. C-L: Political Science 208S. *Paletz*

Romance Studies

French 142S. French Cinema. *Bell*

Italian 170. Film and the Italian Novel. *Finucci*

Slavic Languages and Literature

Russian 130/230. Soviet Cinema. C-L: Literature 178. *Gaines, Jameson, or Lahusen*

Sociology

170. Mass Communication. C-L: Canadian Studies and Comparative Area Studies. *Smith*

182. The Media in Comparative Perspective. C-L: Canadian Studies, Comparative Area Studies,

Interdisciplinary Course 182, and Political Science 180. *Paletz or Smith*

French

For courses in French, see Romance Studies.

Genetics

For courses in genetics, see Biology and the University Program in Genetics.

The University Program in Genetics

Professor F. Ward, *Director* (immunology); Professor Boynton, *Coordinator of the Certificate Program* (botany); Professors Amos (immunology), Antonovics (botany), Bastia (microbiology), Counce (cell biology), Endow (microbiology), Gillham (zoology), Greenleaf (biochemistry), Joklik (microbiology), Keene (microbiology), Kredich (medicine and biochemistry), Laurie (zoology), Modrich (biochemistry), Nevins (microbiology and genetics), Nicklas (zoology), Rausher (zoology), Roses (neurobiology), Shaw (chemistry), Steege (biochemistry), Uyenoyama (zoology), C. Ward (zoology), and Webster (biochemistry); Associate Professors Burdett (microbiology), Cullen (microbiology), Greene (biochemistry), Hsieh (biochemistry), Kreuzer (microbiology), Linney (microbiology), and Schachat (cell biology); Assistant Professors Been (biochemistry), Davis (cell biology), Dong (botany), Garcia-Blanco (microbiology), Garrett (biochemistry), Heitman (genetics and pharmacology), Hershfield (biochemistry), Horowitz (microbiology), Kaufman (biochemistry), Kohorn (botany), Markert (immunology), Ostrowski (microbiology), Pickup (microbiology), Sun (botany), Swenson (cell biology), Titus (cell biology), Vilgalys (botany), and Wharton (genetics and microbiology); Adjunct Professors Drake (National Institute of Environmental Health Sciences), Judd (National Institute of Environmental Health Sciences), Kunkel (National Institute of Environmental Health Sciences), Resnick (National Institute of Environmental Health Science), and Sugino (National Institute of Environmental Health Sciences)

Genetics Program Courses

191, 192. Independent Study. Directed reading and research under the supervision of faculty members from the University Program in Genetics, subject to the consent of the instructor and of the Coordinator of the Certificate Program in Genetics. Variable credit. Staff (Genetics Program)

For descriptions of the courses below consult the listings under the specified departments in the undergraduate and graduate bulletins.

Principles of Genetics. (Biology 180.) One course. *Antonovics, Boynton, Gillham, and Laurie*

Experimental Cell and Molecular Biology (Biology 184L.) *Armaleo, Dong, Kohorn, Siedow, and Sun*

Genetic Mechanisms. (Biochemistry 215.) One course. *Webster and staff*

Molecular Biology II: Nucleic Acids. (Biochemistry 268.) One course. *Steege*

DNA, Chromosomes, and Evolution (Biology 281.) *Laurie and Nicklas*

Molecular Genetics of Organelles. (Biology 283.) One course. *Boynton and Gillham*

Ecological Genetics. (Biology 285S.) One course. *Antonovics*

Evolutionary Mechanisms (Biology 286.) One course. *Antonovics and Uyenoyama*

Independent Study. (Biology 191 and 192.) Prerequisite: consent of instructor, Coordinator of the Certificate Program, and the appropriate Director of Undergraduate Studies prior to registration.

Mathematical Population Genetics. (Biology 288.) Calculus required; statistics and linear algebra recommended. One course. *Uyenoyama*

GENETICS CONCENTRATION FOR BIOLOGY MAJORS

Biology majors interested in completing the concentration in genetics available in that major should consult the Director of Undergraduate Studies in biology.

CERTIFICATE IN GENETICS FOR NON-BIOLOGY MAJORS

A certificate is available in the Genetics Program to all non-biology majors. Acceptance into the certificate program is by arrangement with the Coordinator of the Certificate Program in Genetics. The program offers students an opportunity to gain expertise in modern genetics with a view to its application to biology, medicine, public policy, law, or engineering. The courses in the certificate program are taught by members of the University Program in Genetics. Further details may be obtained from the Genetics Program office.

Required Courses:

Introductory Biology

Principles of Genetics (Biology 180)

An advanced course in molecular genetics, for example,

Experimental Cell and Molecular Biology (Biology 184L)

Molecular Biology II. Nucleic Acids (Biochemistry 268)*

Genetic Mechanisms (Biochemistry 215)†

One course from among: Biology 160, 184L, 244, 269, 281, 283, 285S, 286, 288, or

Biochemistry 215*, 227, 268†

Independent study with a member of the Genetics Program (University Program in Genetics 191, 192)

Geology (GEO)

Professor Corliss, *Chair*; Assistant Professor Boudreau, *Director of Undergraduate Studies*; Professors Barber, Haff, Heron, Johnson, Kay, Livingstone, Perkins, Pilkey, and Schlesinger; Associate Professors Baker, Karson, and Malin; Assistant Professors Klein and Rojstaczer

A major is available in this department.

The department offers introductory and advanced courses in all branches of the earth sciences including coastal geology, environmental geology, hydrology, geochemistry, geomorphology, geophysics, paleontology, petrography, sedimentology, and marine geology. The degree requirements emphasize a broad knowledge of both geology and the associated physical sciences. An option is available for one semester of study at the Duke University Marine Laboratory in Beaufort, North Carolina, to fulfill elective requirements for the degree.

10S. Analysis of Outcrops. (NS) Field interpretation of geologic features. Includes four field trips. Prerequisite: Geology 41 (may be taken concurrently). Half course. *Boudreau*

41. Introduction to Geology. (NS) Earth composition, processes, and structure. One course. *Baker or Heron*

43S. Application of Geologic Principles. (NS) Mineral and rock classification, topographic and geologic map interpretation. Prerequisite: Geology 41 (may be taken concurrently). Half course. *Staff*

*Requires Biochemistry 259 or 227 as a prerequisite.

†Requires Biochemistry 227 as a prerequisite.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

53. Introductory Oceanography. (NS) Basic principles of physical, chemical, biological, and geological oceanography. Fee for required field trip to the Marine Laboratory. C-L: Biology 53. One course. *Pilkey and Searles (biology)*

72L. History of the Earth. (NS) Evolution of the earth and organisms through time. Weekend field trip to the Appalachian Mountains. Lectures and laboratory. Prerequisite: Geology 41 or consent of instructor. One course. *Corliss or Klein*

105L. Fundamentals of Mineralogy. (NS) Crystal chemistry, crystal physics, mineral identification, and genesis. Lectures or recitations, laboratory, and field trips. Prerequisite: Chemistry 12L (may be taken concurrently). One course. *Klein*

106L. Igneous and Metamorphic Rocks. (NS) Silicate mineralogy, theory of origin and classification of igneous and metamorphic rocks, and rock identification. Lectures and laboratory. Prerequisite: Geology 105. One course. *Boudreau*

109. Climatic Change. (NS) Record of changing climate on earth, as determined from the analysis of deep sea sediments, ice cores, lake sediments, and tree rings. (Given at Beaufort.) C-L: Marine Sciences. One course. *Johnson*

110L. Stratigraphy and Sedimentology. (NS) Age relationships, correlation, classification, identification, origins, and interpretation of sediments. Lecture, laboratory, and field trip. One course. *Heron and Perkins*

120. Environmental Geology. (NS) The relation between the human environment, the properties of earth materials, and the occurrence of geological surface processes such as floods, landslides, and erosion. Prerequisite: Geology 41. One course. *Haff and Rojstaczer*

123. Hydrology. (NS) The hydrologic cycle with particular emphasis on surface water flow and associated sediment transport. Prerequisite: Mathematics 32 or consent of instructor. One course. *Rojstaczer*

130. Principles of Structural Geology. (NS) Description, origin, and interpretation of primary and secondary geologic rock structures. Prerequisites: Geology 106 and 110. One course. *Karson*

145. Invertebrate Paleontology. (NS) Biologic and stratigraphic relationships of invertebrates and their phylogeny. Lectures and laboratory. Prerequisite: Geology 72 or consent of instructor. One course. *Corliss*

191, 192. Independent Study. Directed reading or research. Open only to qualified juniors and seniors by consent of Director of Undergraduate Studies and supervising instructor. One course each. *Staff*

195. Independent Study for Nonmajors. Open to qualified juniors and seniors upon approval of the departmental faculty. One course. *Staff*

196S. Beach and Island Geological Processes. (NS) Processes affecting evolution of beaches and barrier islands with emphasis on the effect of constructions. (Given at Beaufort on three weekends.) C-L: Marine Sciences. Half course. *Pilkey*

For Advanced Undergraduates and Graduates

200. Beach and Coastal Processes. (NS) The study of sedimentary processes and geomorphology of nearshore environments with emphasis on both developed and undeveloped barrier island systems. One course. *Pilkey*

201S. Coastal Processes. (NS) Waves and currents in the nearshore zone and their role in beach evolution. Linear wave theory and models for beach evolution. Other topics include nearshore currents, tides, estuarine circulation, and field techniques for measurement of nearshore morphology and fluid motions. Term project required. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Environment 222S and Marine Sciences. Half course. *Howd*

203. Physical Oceanography. (NS) Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. Prerequisites: Mathematics 31 and 32 or consent of instructor. C-L: Environment 290 and Marine Sciences. One course. *Lozier*

205S. Geological Oceanography. (NS) The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 206S. (Given at Beaufort.) C-L: Environment 291S and Marine Sciences. One course. *Johnson*

206S. Principles of Geological Oceanography. (NS) Geological aspects of the ocean basins including coastal to deep water sediment types and sedimentation processes, sea floor physiography and environmental problems. One course. *Pilkey*

208S. Paleoceanography. (NS) Geology, paleoceanography, and evolution of the oceans, ocean basins, and marine biota based on analysis of deep-sea sedimentary sequences. One course. *Corliss*

209. Climatic Change. (NS) Record of changing climate on earth, as determined from the analysis of deep sea sediments, ice cores, lake sediments, and tree rings. (Given at Beaufort.) C-L: Marine Sciences. One course. *Johnson*

212. Carbonate Facies Analysis: Recent and Ancient. (NS) Origin, distribution, and diagenetic alteration of recent carbonate sediments and their ancient analogs. Prerequisite: Geology 110L. One course. *Perkins*

214S. Sedimentary Petrography. (NS) Descriptive and interpretive analysis of sediments and sedimentary rocks in thin section, with an emphasis on diagenesis. Consent of instructor required. One course. *Perkins*

215. Clastics Facies Analysis: Recent and Ancient. (NS) Modern clastic depositional systems and their ancient analogs. Prerequisite: Geology 110L. One course. *Heron*

216. Field Analysis of South Florida Carbonates. (NS) Analysis of recent sediments and organisms and their Pleistocene analogs. One-week field trip. Pass/fail grading only. Prerequisite: Geology 110L or consent of instructor. Half course. *Perkins*

218. Geological Fluid Mechanics. (NS) Physical properties of fluids. Continuity, momentum, and energy principles. Laminar and turbulent flow; potential flow; open channel flow. Applications to stream and watershed hydraulics, sediment transport, and other geological phenomena. Prerequisites: Mathematics 31 and 32, Physics 41L and 42L, or Engineering 75L. One course. *Haff*

219. Sediment Transport. (NS) The processes by which wind and water move sedimentary material. Prerequisites: Civil Engineering 122L or Geology 41 and 218. One course. *Haff*

220. Earth Surface Processes and Geomorphology. (NS) The origin, nature, and significance of natural features on the earth's surface. Prerequisites: open to graduates and advanced undergraduates with consent of instructor. One course. *Haff*

221. Hydrogeology. (NS) Theory of groundwater flow and solute transport with application to geologic processes. Prerequisite: Chemistry 12L, Physics 42L or 52L, or consent of instructor. One course. *Rojstaczer*

222L. Techniques in Environmental Data Analysis. (NS) Introduction to techniques commonly used by environmental scientists for the study of spatial and cross-spectral analysis and empirical orthogonal functions. Emphasis on developing a hands-on understanding of the methods and correct interpretation of results. Lectures and laboratory. Term project required. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Environment 252L and Marine Sciences. One course. *Howd*

223. Numerical Methods in Hydrogeology. (QR) Finite difference and finite element methods to solve partial differential equations encountered in hydrogeology. Prerequisite: Computer Science 53, Geology 221, Mathematics 103, or consent of instructor. One course. *Rojstaczer*

225S. Advanced Topics in Hydrogeology. (NS) Hydrologic controls on the chemical and physical state of the earth's crust. Prerequisite: Geology 221 or consent of instructor. One course. *Rojstaczer*

233S. Oceanic Crust and Ophiolites. (NS) Structure, tectonics, petrology, and geochemistry of oceanic spreading environments and ophiolite complexes. Prerequisites: Geology 106L and 130 or consent of instructor. One course. *Karson*

237S. Structure and Evolution of the Appalachian Orogen. (NS) Overview of sedimentation, deformation, and metamorphism responsible for the development of the Appalachian Mountain Belt from Newfoundland to Alabama in the context of plate tectonics. Prerequisites: Geology 106L, 110L, and 130 or consent of instructor. One course. *Karson*

249. Marine Micropaleontology. (NS) Introduction to marine microfossils, basic principles of micropaleontology and stable isotope geochemistry with applications to paleoceanography. Lectures and laboratory. One course. *Corliss*

251. Introduction to Geophysics. (NS) A survey of the earth's heat flow, gravitational, magnetic and electrical potential fields, and global seismology. Derivation of basic relationships and their application to the solution of geological problems. Prerequisite: upper-division mathematics or science courses. One course. *Malin*

252. Seismic Exploration of the Lithosphere. (NS) A survey of seismic wave generation, propagation, detection, analysis, and interpretation in the continental and oceanic lithosphere with practical applications to geological and industrial problems. Prerequisite: upper-division mathematics or science courses. One course. *Malin*

255. Theoretical Geophysics I: Diffusion and Wave Motion in the Earth, Part I. (NS) Theoretical and practical quantitative methods for seismological and groundwater research. Differential and integral equations for diffusion and wave motion; analytical solutions and numerical methods. Elementary continuum mechanics. Time series analysis. Emphasis varies depending on enrollment. Prerequisite: enrollment in an advanced degree program in earth sciences or related fields, or consent of instructors. One course. *Malin and Rojstaczer*

256. Theoretical Geophysics II: Diffusion and Wave Motion in the Earth, Part II. (NS) Theoretical and practical quantitative methods for seismological and groundwater research. Differential and integral equations for diffusion and wave motion; analytical solutions and numerical methods. Elementary continuum mechanics. Time series analysis. Emphasis varies depending on enrollment and the contents of Geology 255. Prerequisite: Geology 255 or consent of instructors. One course. *Malin and Rojstaczer*

258S. Advanced Topics in Geophysics: Interdisciplinary Approaches to Problems in Tectonics, Seismology, and the Environment. (NS) Crustal structure of the western United States; use of seismic reflection and microearthquake data for imaging active geological processes, earthquake prediction; scattering of seismic waves. Consent of instructor required. One course. *Malin*

260S. Applied Subsurface Stratigraphy. (NS) Overview and application of tools, techniques, and procedures for analysis of subsurface strata. Logging methods for cuttings and cores, principles and application of wire-line logs, interpretation of seismic sections, mapping and correlation procedures, and the application of computers to stratigraphic analysis. Prerequisite: Geology 110L. One course. *Perkins*

269. Theoretical Geochemistry. (NS) Introductory thermodynamics applied to geologic problems through understanding of phase equilibrium. Prerequisites: Geology 105L (may be concurrent) and Mathematics 32. One course. *Boudreau*

271. Isotope Geochemistry. (NS) Theory and applications of stable and radioactive isotope distributions in nature. Prerequisites: Chemistry 12L and Mathematics 32. One course. *Baker*

272. Biogeochemistry. (NS) Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and surficial processes. Prerequisite: Chemistry 12L or equivalent. C-L: Biology 272. One course. *Schlesinger*

285S. Layered Intrusions. (NS) Survey of layered igneous intrusions and current theories on crystallization and other processes in mafic magmas. Offered alternate years. Prerequisites: Geology 105L and 106L or consent of instructor. One course. *Boudreau*

292. Computer Methods in Geology. (NS) Techniques used in the geological sciences including simulation and forward modeling, inverse and least squares methods, statistical methods and exploratory data analysis as well as graphics. Prerequisites: Computer Science 53 and Mathematics 32, or consent of instructor. One course. *Staff*

295S. Advanced Topics in Geology. (NS) Topics, instructors, and credits to be arranged each semester. Variable credit. *Staff*

COURSES CURRENTLY UNSCHEDULED

45. Earth Resources. (NS)

204. Chemical Oceanography. (NS)

217. Field Analysis of Ancient Sedimentary Sequences. (NS)

230S. Advanced Topics in Structural Geology and Tectonics. (NS)

236S. Lithosphere Plate Boundaries. (NS)

270. Sedimentary Geochemistry. (NS)

275. Economic Geology. (NS)

281S. Advanced Topics in Igneous Petrology. (NS)

283S. Experimental Methods in Geology. (NS)

THE MAJOR

For the A.B. Degree in Earth Sciences

The A.B. degree in Geology is designed to be a flexible major for those students whose interest is in the professional fields allied to geology (for example, land use

planning, resources management, environmental law, engineering geology, or secondary education), but who do not plan on pursuing advanced studies in the earth sciences or becoming professional geologists.

Prerequisites. Geology 10 (half course), 41, 43S (half course), and 72; Chemistry 11L and 12L, or Mathematics 31 and 32, or Physics 41L and 42L, or 51L and 52L, or Physics 53L and 54L.

Major Requirements. Geology 105 and five 100-level courses or above, at least three in geology, that are in some way related to the student's interest and approved in advance by the student's advisor.

For the B.S. Degree

The Department of Geology offers *three* programs:

Geology: Preparatory to Advanced Studies in Geology

The B.S. degree in Geology provides a strong background for graduate work in the earth sciences for those who wish to become academic or professional geologists in any of its many subfields.

Prerequisites. Geology 41 and 72L; Chemistry 11L and 12L; Mathematics 31 and 32; Physics 41L and 42L or Physics 51L and 52L.

Major Requirements. Required courses include Geology 105L, 106L, 110L, 130, a field course normally taken during the summer after the junior year, and four geological electives above Geology 100.

Additional recommended courses. Although it is not a specific requirement, students interested in advanced studies in the following fields should consider taking the additional courses during their undergraduate career while at Duke with the advice of their faculty advisor. Students interested in advanced studies in *geochemistry*, *hydrogeology*, *petrology*, or *structural geology* should consider taking the following additional courses: introductory statistics, second-year mathematics (ordinary differential equations, linear algebra), computer programming, and physical chemistry. Students interested in advanced studies in *geophysics* should consider taking the following additional elective geology courses: Geology 251, 255, 256, and 258. In addition, they should consider taking courses in classical mechanics, electricity and magnetism, second-year mathematics (ordinary differential equations, linear algebra), and mathematical physics. Students interested in advanced studies in *paleontology* should consider taking the following additional elective geology courses: Geology 145, 208, and 249. They should also consider taking additional courses in introductory statistics, and postintroductory courses in anatomy, biology, botany, and ecology.

Geology: Preparatory to Advanced Studies in Environmental Earth Sciences

For this B.S. degree interested students may work with departmental faculty members to plan a specialized course sequence in a variety of areas relating to environmental earth sciences. Areas of specialization include coastal studies, global change, hydrology, earth surface processes (geomorphology), and environmental geology. Courses in these areas can be combined with related courses in departments such as Civil and Environmental Engineering, Botany, Zoology, and the School of the Environment to create an educational experience tailored to individual student interests.

Prerequisites. Geology 41 and 72L; Chemistry 11L and 12L; Mathematics 31 and 32; Physics 41L and 42L, or Physics 51L and 52L, or Physics 53L and 54L.

Major Requirements. Geology 105, Geology 120, and five additional courses selected from the following with approval of the student's advisor: Geology 106L, Geology 109, Geology 110L, Geology 123, Geology 130, Geology 196, Geology 200, Geology 219, Geology 221, Geology 249, Geology 257, Geology 269, Geology 270, Geology 272, Geology 273, Geology 275, and Biology 216L. Of these five, the student may substitute

up to two courses in geology or in other departments, with permission of the student's departmental advisor.

Additional recommended courses. Students interested in advanced studies in *environmental earth sciences* should consider taking additional courses in the following fields: introductory statistics, second-year mathematics (ordinary differential equations, linear algebra), computer programming, and advanced chemistry. Students interested in *field research* are strongly urged to take a geology field course normally the summer of their junior year, but should note that summer field camps usually require Geology 106L, 110L, and 130 as prerequisites.

Geology: Preparatory to Advanced Studies in Oceanography

The B.S. in Oceanography is designed for those who wish to pursue advanced studies in oceanography and geological oceanography.

Prerequisites. Geology 41, 72L, and Geology 53 or 206S; Chemistry 11L and 12L; Mathematics 31 and 32; Physics 41L and 42L, or Physics 51L and 52L; and two full-course science electives.

Major Requirements. A minimum of five geology courses above the introductory level, including Geology 105L, 106L, 110L, and 130.

Additional recommended courses. Although it is not a requirement, students interested in advanced studies in *oceanography* should consider taking the following additional courses with the advice of their faculty advisor: introductory statistics, second-year mathematics (ordinary differential equations, linear algebra), computer programming, organic and physical chemistry.

Germanic Languages and Literature

Professor Rolleston, *Chair*; Assistant Professor Bessent, *Director of Undergraduate Studies and Supervisor of Freshman Instruction*; Professors Alt and Borchardt; Associate Professor Morton; Assistant Professors Hell and Rasmussen; Professor Emeritus Phelps; Lecturers Dowell and Johns

A major is available in this department.

GERMAN (GER)

Language

1-2. Elementary German. (FL) Practice in understanding, speaking, reading, and writing. Classroom techniques are combined with those of the language laboratory and the computer. Two courses. *Bessent and staff*

14. Intensive German. (FL) Accelerated introduction to German, combining in one semester the work of German 1-2. Classroom theory and practice with extended exposure to language laboratory and computer programmed instruction. Consent of Director of Undergraduate Studies required. Two courses. *Staff*

15. German for Reading Knowledge. (FL) Foundations of German grammar and syntax; emphasis on vocabulary and complex verbal structures. Not open for credit to students who have completed German 1-2, 14, or the equivalent. Students continuing German after German 15 should take the placement test. One course. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

63. Intermediate German. (FL) Prerequisite: German 1-2 or equivalent. One course. *Dowell and staff*

German 63 is usually followed by 100S, 117S, 121S, or 122S.

65-66. German in Review. (FL) Grammar review, reading of literary and cultural texts, oral practice, laboratory, and computer programmed instruction. Not open to students who have had German 63. Prerequisite: for German 65-66, German 1-2, 14, or equivalent; for German 66 alone, appropriate placement test score or consent of instructor. Two courses. *Dowell*

67. Intensive Intermediate German. (FL) Intensive grammar review and practice of spoken and written German combining in one semester the work of one year of intermediate German. Taught only in the Berlin Fall Semester Program. Prerequisite: German 1-2, 14, or equivalent. Two courses. *Staff*

99. Introduction to German. Course credit for a score of 4 or 5 on the College Board Advanced Placement tests in German. One course.

100S. Business German. (FL) Introduction to the language of commerce and industry; modes of expression for technology and marketing. Consent of instructor required. One course. *Staff*

117S, 118S. German Conversation and Composition. (FL) Primarily conversation with oral and written reports, based on works by contemporary writers. Required for German majors; other students by consent of instructor. One course each. *Bessent, Dowell, or Johns*

Literature and Culture

121S, 122S. Introduction to German Literature. (AL, FL) Principal authors, genres, concepts, and works of German literature. 121S: Middle Ages to the Baroque. 122S: Enlightenment to the present. Not open to students who have taken German 101. One course each. *Staff*

123S, 124S. Undergraduate Seminars. (AL, FL) Topics vary. Not open to students who have taken German 103S, 104S. One course each. *Staff*

125S. Literature of Tolerance. (AL, FL) The liberal tradition in German letters from the Reformation through the Enlightenment to the twentieth-century religious and political dissent. One course. *Borchardt*

130S. From Enlightenment to Classicism. (AL, FL) The major literary and cultural movements of the eighteenth century: Enlightenment, sentimentalism, *Sturm und Drang*, Weimar classicism. Representative works of Lessing, Klopstock, Herder, Goethe, Schiller, and Lenz. Not open to students who have taken the former German 124S (Reason and Imagination). One course. *Morton*

131S. The Novelle. (AL, FL) The unique German prose genre from Tieck, Kleist, Grillparzer, Keller, Droste-Hülshoff to Hauptmann, Kafka, and Grass. History and theories from romanticism to naturalism. Not open to students who have taken German 109S. One course. *Alt, Bessent, or Morton*

132S. The Märchen. (AL, FL) Fairy tales as literary genre; historic relevance, function, types of Märchen from Volksmärchen (brothers Grimm) to Kunstmärchen (Goethe, Brecht, Bichsel) to the anti-Märchen (Karsunke, Gilbert). Not open to students who have taken German 109S. One course. *Bessent*

136S. Contemporary Germany. (AL, FL) The current literary scene in its cultural, social, and political contexts. Not open to students who have taken German 127S. C-L: Comparative Area Studies. One course. *Bessent or Hell*

137S. Introduction to Twentieth-Century German Women Writers. (AL, FL) This century's preeminent German women writers placed in historical and cultural context. Elementary concepts of literary analysis; emphasis on speaking and writing German.

Readings in Bachmann, Seghers, Wolf. Other authors may include: Aichinger, Fleisser, Frischmuth, Kaschnitz, Leutenegger, Morgner, H. Müller, Rinser, Struck. C-L: Women's Studies. One course. *Hell or Rasmussen*

199S. Senior Seminar in German Studies. (CZ) See C-L: Interdisciplinary Course 199S. One course. *Rolleston and staff*

Courses Taught Overseas

150. Composition. (FL) Syntax with practice in the elements of German expository style. Offered as a part of the summer program at the University of Erlangen. Not open to students who have taken German 105. One course. *Staff*

151S. Advanced Intensive German. (FL) For advanced students to increase all four language skills: comprehension, speaking, reading, and writing. Discussion of current events based on newspaper articles, radio and television reports. Preparation for the German language examination required of all foreign students enrolling at German universities. Equivalent of German 117S or 118S but offered only in the Berlin semester program. Not open to students who have taken German 119S. One course. *Staff*

152S. Berlin in Contemporary German Literature. (AL, FL) Literary works with special focus on the German question and especially on Berlin and its unique cultural and political situation. Offered only in the Berlin semester program. Not open to students who have taken German 120S. C-L: Comparative Area Studies. One course. *Staff*

153. Aspects of Contemporary German Culture. (CZ, FL) Site visits, lecture, and discussion. Offered as part of the summer program at the University of Erlangen. Not open to students who have taken German 137. C-L: Comparative Area Studies. One course. *Staff*

Courses Taught in English

123A, S. Special Topics. Taught in English by visiting faculty. One course. *Staff*

160. German Life and Thought. (CZ) A survey of what the well-educated German knows about German-speaking Europe, from antiquity to the present, with a stress on generally less familiar periods. Architecture, art, education, literature, music, philosophy, and science. Taught in English. Not open to students who have taken German 130. C-L: Comparative Area Studies. One course. *Borchardt*

174S. In Search of the Self: The German Bildungsroman. (AL) The German novel of development of character (*Bildungsroman*), from the eighteenth to the twentieth century; its role in shaping modern prose fiction. Readings in Goethe, Hölderlin, Mann, and Hesse; also Dickens, Twain, Joyce, and Proust. Taught in English. One course. *Morton*

180. Faust and the Faust Tradition. (AL) Goethe's great work in the context of its intellectual and cultural inheritance and legacy. Taught in English. Not open to students who have taken German 173. One course. *Borchardt or Morton*

184S. Rilke, Kafka, Mann, Brecht. (AL) The shaping of twentieth-century thought by those literary figures whose writing has become world literature. Taught in English. Not open to students who have taken German 172. One course. *Borchardt, Morton, or Rolleston*

Independent Study and Honors Seminars

191, 192. Independent Study. Directed reading and research. Open only to qualified students in the junior year, by consent of the Director of Undergraduate Studies. One course each. *Alt, Bessent, Borchardt, Hell, Morton, Rasmussen, or Rolleston*

193, 194. Independent Study. Directed reading and research. Open only to qualified students in the senior year, by consent of the Director of Undergraduate Studies. One course each. *Alt, Bessent, Borchardt, Hell, Morton, Rasmussen, or Rolleston*

197S, 198S. Honors Program Sequence. (AL, FL) 197S: Senior Colloquium; team taught. 198S: Preparation and writing of research paper. See section on *Honors* under description of the major. One course each. *Staff*

For Graduates and Advanced Undergraduates

200S. Proseminar: Introduction to Literary Criticism. (AL, FL) Literary theory within the framework of Germanistik, combining a survey of the major critical approaches which developed after 1945 with the discussion of several paradigmatic readings of literary texts. Approaches studied include New Criticism, hermeneutics, Marxist critical theory, reception aesthetics, structuralism, poststructuralism, and feminist literary criticism(s). Not open to students who have taken the former German 200S (Proseminar). One course. *Hell*

201. Introduction to Middle High German: The Language of the German Middle Ages and Its Literature. (AL, FL) Fundamentals of medieval German language acquired through readings in the original Middle High German of Arthurian romance, heroic epic, and courtly poetry. Not open to students who have taken German 205. C-L: Medieval and Renaissance Studies. One course. *Rasmussen*

202S. Medieval Seminar. (AL, FL) Topics may include: heroic epic, courtly epic, medieval poetics, German lyric poetry from the twelfth to the fifteenth century. Solid reading knowledge of modern German and some knowledge of medieval German required. Not open to students who have taken German 206. C-L: Medieval and Renaissance Studies. One course. *Rasmussen*

203S. Sex, Gender, and Love in Middle High German Literature. (AL, FL) Historical contexts for emergence of courtly love and the role of desire and interpretation in Gottfried von Strassburg's *Tristan und Isolde*, courtly love lyric, "maere." C-L: Medieval and Renaissance Studies. One course. *Rasmussen*

210S. Renaissance and Reformation. (AL, FL) The development of "personality" from "type" to "individual" in German culture in the great transition from medieval to early modern times, with examples from literature, history, art, architecture, music, science, and religion. Emphasis on the Italian connection, northern mysticism, Prague in the fourteenth century, fifteenth-century poetry and prose, and Luther. Not open to students who have taken German 217S. C-L: Medieval and Renaissance Studies. One course. *Borchardt*

215S. German Baroque Literature. (AL, FL) German literature of the grand gesture, of performance, of public posture; poetry of rhetoric; prose of the scoundrel, adventurer, and ne'er-do-well. Not open to students who have taken the former German 215S (Seventeenth-Century Literature). C-L: Medieval and Renaissance Studies. One course. *Borchardt*

220S. Reason and Imagination: The German Eighteenth Century. (AL, FL) Advanced study of selected topics, from the beginnings of Enlightenment to the transition to Romanticism. Not open to students who have taken the former German 210S (The Eighteenth Century). One course. *Morton*

225S. Introduction to Goethe. (AL, FL) Major works of lyric, narrative, drama, and theory, throughout Goethe's career. Not open to students who have taken the former German 201S. One course. *Morton*

226S. Goethe's *Faust*. (AL, FL) Goethe's masterpiece and life's work, conceived as a summation of Western literature and mythology for the modern age. Not open to students who have taken the former German 202S (Goethe). One course. *Morton*

227S. Goethe Seminar. (AL, FL) Selected texts or other aspects of Goethe's life and work not treated in German 225S or 226S. Topics may include autobiography, scientific writings, longer novels, late lyrics, literary theory and criticism, as well as others. One course. *Morton*

229S. Schiller: Aesthetic Theory and Practice. (AL, FL) The nature and function of the artist and the work of art, in Schiller's essays, poetry, and dramas. One course. *Borchardt, Morton, or Rolleston*

230S. German Romanticism. (AL, FL) The emergence in the 1790s of a new cultural language: categories of self, history, interpretation, irony, and revolution. Theory, fiction, and poetry by Novalis, the brothers Schlegel, Tieck, Brentano, Eichendorff, Hoffmann, and Heine. Not open to students who have taken German 207S. One course. *Rolleston*

232S. The Lyric: Goethe to the Present. (AL, FL) Poetry and its cultural meanings from versions of the modern *Ich* generated by Goethe, Hölderlin, and the romantics to the ironic new subjectivity of the 1970s. Emphasis on Mörike, Heine, Droste-Hülshoff, Rilke, Benn, Celan, Enzensberger, and Karin Kiwus. Not open to students who have taken the former German 230S (Lyric Poetry). One course. *Rolleston*

233S. German Theater as Anti-Drama. (AL, FL) The story of modern and postmodern drama with emphasis on Lenz, Büchner, Grabbe, Schnitzler, Brecht, Frisch, Dürrenmatt, Handke, expressionist drama, and Piscator's political theater. Not open to students who have taken German 209S. C-L: Drama 220S. One course. *Alt*

235S. Nineteenth-Century German Literature. (AL, FL) Topics vary: poetry, prose, drama; Kleist, Heine, Büchner, Keller, Meyer, Gotthelf, Grillparzer, Mörike, Storm, Freytag, Hebbel, Fontane. Not open to students who have taken German 211S. One course. *Alt*

245S. The Twentieth Century. (AL, FL) The major movements and writers from the expressionists, Thomas Mann, Kafka, Rilke, and Brecht, to Böll, Grass, Handke, and Christa Wolf. Emphasis on relations between text and history: World War I, Weimar, Third Reich, and the struggle to integrate past and present in post-Holocaust literature. Not open to students who have taken German 214S. One course. *Rolleston*

246. German Letters in the Third Reich and in Exile. (AL, FL) German literature, drama, and film inside and outside Nazi Germany. Theoretical readings in Bloch, Benjamin, and others. One course. *Hell*

247S. Postwar German Literature. (AL, FL) The development of German literature after 1945. Topics vary: German literature between 1945 and the founding of the two states; the GDR novel and the question of realism; GDR drama after Brecht; West German literature. One course. *Hell*

250S. German Literature and Classical Antiquity. (AL, FL) The reception of Greece and Rome in German letters; the triumph and decline of classical rhetoric; the idea of the "classical"; antiquity as model and reproach. One course. *Borchardt*

Linguistics

260. History of the German Language. (FL) Phonology, morphology, and syntax of German from the beginnings to the present. Not open to students who have taken German 216. C-L: Linguistics and Medieval and Renaissance Studies. One course. *Rasmussen*

261. Second-Language Acquisition Theory and Practice. (FL) Modern teaching techniques; problems in the teaching of German on the secondary and college levels. Analysis and evaluation of textbooks, related audiovisual materials, and computer programs. Not open to students who have taken German 218S. One course. *Staff*

262. Applied Linguistics. (FL) The application of modern linguistic principles to a systematic study of the phonetics, morphology, and syntax of modern German. Not open to students who have taken German 219. C-L: Linguistics. One course. *Staff*

Courses Taught in English

244S. International Expressionism. (AL) See C-L: Art 244S. One course. *Cernuschi and Rolleston*

270. Consciousness and Modern Society. (CZ) The blend of philosophy, literature, and sociology in German thinking about actual and possible societies. The idea of consciousness as producing involvement, detachment, or transformation. Marx, Nietzsche, Lukacs, Freud, Marcuse, Benjamin, Adorno, and Habermas. Taught in English. Not open to students who have taken German 175. C-L: Comparative Area Studies. One course. *Rolleston*

Courses Currently Unscheduled

134S. Contemporary German Theater. (AL, FL)

135. German Literature and the Media. (AL, FL)

154. Deutsche Kulturgeschichte. (CZ, FL)

164S. Medieval German Literature. (AL)

165S. The Vikings and their Literature. (AL)

170S. The German Enlightenment and the Invention of Modernity. (AL)

185S. The Golden 'Twenties. (AL)

231S. Romantic Outsiders. (AL, FL)

236S. Empires of the Mind: Nineteenth-Century German Ideas. (AL, FL)

240S. Naturalism and Beyond: The Turn of the Century. (AL, FL)

241S. Nietzsche. (AL, FL)

242S. Expressionism. (AL, FL)

251S. Germanic Mythology and Its Critics. (AL, FL)

252S. The Mystical Tradition. (AL, FL)

253S. The Image of America in German Literature. (AL, FL)

254S. Literature by Women. (AL, FL)

255S. Paradigmatic Issues in Literary Theory. (AL, FL)

271S. Contemporary Theory and the German Tradition. (AL)

272S. The German Literature of Fantasy. (AL)

273S. Franz Kafka and Thomas Mann. (AL)

274S. The Image of America in German Literature. (AL)

275S. German Women Writers. (AL)

YIDDISH (YDH)

1, 2. Elementary Yiddish. (FL) A thorough study of elementary Yiddish grammar with reading, composition, and oral practice. No previous knowledge of German or Hebrew required. C-L: Judaic Studies. One course each. *Staff*

170. Special Topics in Literature and the Judaic Tradition. (AL) See C-L: Literature 131; also C-L: Judaic Studies. One course. *Zucker or staff*

Courses Currently Unscheduled

171. Yiddish Fiction in Translation. (AL)

191, 192. Independent Study

THE MAJOR

Students majoring in German develop language skills in their cultural and literary context. The international and humanistic emphasis makes the German major an appropriate companion to technical and career-oriented concentrations. Numerous opportunities are available, including programs of study abroad, interdisciplinary programs, and Fulbright and German Academic Exchange Service (DAAD) scholarships.

Prerequisites. Elementary and intermediate German.

Major Requirements. Conversation and composition (German 117S, 118S, or equivalent), plus six advanced courses, three of which must be at the 200 level. German 121S or 122S is required as part of the six-course sequence. Of the courses taught in English, either German 160 or 270 (but not both) may count toward the major.

Honors/Distinction. Qualified students (see the section on honors in this bulletin) may apply or be invited to apply for graduation with distinction or to achieve Latin honors by project. The application deadline is preregistration for the fall semester of the senior year. Further information may be obtained from the Director of Undergraduate Studies or the departmental honors representative.

Greek

For courses in Greek, see Classical Studies.

Health, Physical Education, and Recreation (PE)

Professor Buehler, *Chair*; Associate Professor Spangler, *Director of Undergraduate Studies*; Associate Professors Harvey, LeBar, Raynor, Skinner, and Woodyard; Part-time Instructors Beguinet, Bowen, D. Coffman, T. Coffman, Falcone, Forbes, Hillier, Hopkins, Jindra, Ogilvie, Orr, Ozer, Rollins, Spector, Trout, Vanstone, Wilson, and Yakola

Courses in this program do not count toward distributional requirements.

ACTIVITY COURSES

The activity courses listed below may be taken by men and women unless otherwise indicated. Each course carries a half-course credit and is given on a pass/fail basis. The maximum amount of credit that counts for the undergraduate degree is one full course, but additional courses may be taken without credit toward graduation. Students may repeat activity courses but will not receive credit for the repeated courses.

11. Cardiorespiratory Conditioning and Aerobics. Individualized programs in walking, jogging, running, cycling, and swimming. Half course. *Buehler*

12. Dancing for Health. Dancing for cardiovascular and physical conditioning. Half course. *Jindra*

13. Weight Control. Individualized exercise and diet programs. Consent of physician required. Half course. *Staff*

14. Tension Control. Techniques for recognizing and reducing tension. Half course. *Staff*

15. Weight Training. Progressive, cumulative, and measurable physical conditioning. Half course. *Harvey*

16. Endurance Swimming. Individualized programs to improve skills and fitness. Half course. *Spangler*

20. Beginning Swimming. Propulsion techniques, water safety, introduction to the five basic strokes. Half course. *Spangler*

21. Intermediate Swimming. Development of the five basic strokes, overarm side trudgen, and trudgen crawl. Half course. *Spangler*

22. Lifeguard Training. American Red Cross course which prepares an individual to qualify as a *non-surf* lifeguard. Preventative lifeguarding, emergencies, health and sanitation, water rescue and special situations, search and recovery operations, weather and environmental conditions. Corequisites: must have CPR and Red Cross Standard First Aid certification by the end of the course in order to receive Lifeguard Training certification. Half course. *Forbes*

24. Basic Rescue and Emergency Water Safety. Prerequisite for Water Safety Instructors Course. Half course. *Woodyard*

25. Water Safety Instructors Course. American Red Cross Water Safety Instructors certification. Prerequisite: Physical Education 24. Half course. *Woodyard*

27. Kayaking. Basic skills for kayaking in whitewater. Half course. *Harvey*

28. Canoeing. Basic skills for canoeing in whitewater. Half course. *Staff*

29. Water Polo. Prerequisite: Physical Education 16 or consent of instructor. Half course. *Forbes*

30. Beginning Golf. Half course. *T. Coffman*

31. Intermediate Golf. Stroke development and use of all clubs. Half course. *T. Coffman*

32. Advanced Golf. Use of all clubs; course strategy. Emphasis on playing. Half course. *T. Coffman*

35. Beginning Racquetball. Half course. *Skinner*

36. Intermediate Racquetball. Strategy of the game; stroke development. Half course. *Skinner*

37. Advanced Racquetball. Development of competitive skills. Half course. *Skinner*

40. Beginning Tennis. Half course. *LeBar*

41. Intermediate Tennis. Strategy of the game and stroke development. Half course. *LeBar*

42. Advanced Tennis. Stroke development with emphasis on strategy. Half course. *LeBar*

48. Men's Competitive Tennis. High level drills, strategy, mental and physical conditioning for those interested in tennis competition. Half course. *LeBar*

50. Mixed Competitive Tennis. See Physical Education 48. Half course. *LeBar*

52. Fencing. Foils, épée, and saber. Half course. *Beguinet*

53. Intermediate Fencing. Further study of basics and theory. Half course. *Beguinet*

55. Self-Defense: Karate. Fundamentals of selected martial arts. Half course. *Bowen*

56. Intermediate Karate. Continued practice of basic technique. Introduction to round kick, back kick, free sparring, four Pinan Katas of the Wadoryu System. Half course. *Bowen*

59. Aikido. A method of unarmed self-defense that encourages discipline and a nonviolent attitude. Half course. *Bowen*

60. Volleyball. Half course. *Hopkins*

65. Yoga. Traditional hatha yoga combined with balanced structural alignment to develop strength, flexibility, and mental concentration. Half course. *Orr or Spector*

66. Intermediate Hatha Yoga. Continuation of hatha yoga postures and awareness of breathing to develop more flexibility and calmness. Yoga philosophy. Prerequisite: previous experience with yoga. Half course. *Orr*

71. Country/Western Dancing. Texas two-step, East Coast swing, cha-cha, waltz, and country line dancing. Half course. *Trout*

72. Social Dancing. Waltz, foxtrot, tango, cha-cha, rumba, jitterbug, rock, disco, and others. Half course. *Trout*

73. Intermediate Social Dance. Review of dances in Physical Education 72. Advanced movements in these dances and beginning movements in slow dancing, California two-step, and West Coast swing. Introduction to international and modern ballroom dance. Prerequisite: Physical Education 72 or equivalent. Half course. *Trout*

80. Equitation. Skills in balance seat riding: walk, trot, and canter. Half course. *Rollins*

81. Advanced Equitation: Hunt Seat. Cross-country and stadium jumping techniques. Half course. *Rollins*

96. Basketball. Development of individual and team skills. Half course. *Hillier*

98. Frisbee. Study of basic throwing and catching skills, introduction to rules and tactics of ultimate frisbee, disc golf, freestyle moves, and individual event techniques. Half course. *Staff*

THEORY COURSES

100. Advanced First Aid and Cardiopulmonary Resuscitation. Certification in advanced first aid and CPR. Half course. *Raynor*

112. Sexuality, Stress, and Substance Abuse: Choices, Risks, and Consequences. Emphasis on enriching the individual's capacity for a healthy sexual, social, and academic lifestyle. Half course. *Staff*

115. Care and Prevention of Athletic Injuries. Basic instruction in prevention, recognition, care, and rehabilitation of athletic related injuries. Half course. *Staff*

150. Health, Fitness and Wellness. Relationships among health, wellness, exercise, nutrition and fitness. Scientific evidence pertaining to diet and nutrition, weight control, cardiovascular and strength fitness, stress management, tension control, and drugs and alcohol. Development of a personal lifetime fitness program. One course. *LeBar*

170. History and Issues of Sports. Sports from ancient to modern times with an emphasis on sports in America. One course. *Buehler*

172. Administration in Sports Management. Philosophy, financial structure, administrative structure, fund-raising, NCAA legislation, personnel decision, and scheduling events. One course. *Buehler*

COURSES CURRENTLY UNSCHEDULED

26. Scuba Diving

49. Women's Competitive Tennis

70. Folk Dancing

93. Orienteering

95. Wilderness Skills

110. Diet and Nutrition

Health Policy Program

Assistant Professor Sprinkle, *Director*

A certificate, but not a major, is available in this program.

The Health Policy Certificate Program offers undergraduates an opportunity to gain certification for successful completion of a sequence of courses dealing with a range of health-policy topics.

Undergraduate candidates fulfill program prerequisites by passing basic courses in both economics and policy analysis. They then earn certification by completing:

—two of six core courses (see * below)

—any one other "Background," "Methods," or "Applications" course, and

—Public Policy Studies 255, Health Policy Analysis, an integrative group project.

Formal entry into the program normally occurs at approximately the same time the student selects a major. However, certification also is available to undergraduates who have completed program requirements before formal entry into the program, assuming they are still able to enroll in Public Policy Studies 255, Health Policy Analysis.

Course selection is advised and approved by a designated member of the program faculty. Program requirements can be adapted to changes in course availability and to exceptional individual circumstances.

General Prerequisites

Economics 2D or 52D. Competition, Monopoly, and Welfare. *Staff*

Public Policy Studies 55D. Analytical Methods for Public Policy-Making. *Staff*

Background Courses

Cultural Anthropology 145. Medical Anthropology. *Staff*

History 189. Medicine in the West. *Green*

History 199. The History of Women in Science and Medicine. *Green*

History 279, 280. Health, Healing, and History. *English*

Philosophy 118. Philosophical Issues in Medical Ethics. *Cooper*

Psychology 109. Health Psychology: Introduction and Survey. *Anderson or Gil*

Religion 157. Bioethics in Contemporary Contexts. *McCullough*

Religion 159. Ethical Issues in Health Care. *McCullough*

Sociology 162. Health and Illness in Society. *Weinberger*

Methods Courses

Biometry 217. Medical Decision Analysis: What Does Clinical Research Have to Do with Clinical Practice? *Matchar*

*Economics 156. The Economics of Health Care. Prerequisite: Economics 2D or 52D. *Sloan*

Economics 215S. Applied Cost Benefit Analysis. Prerequisite: Economics 149. *Staff*

*Public Policy Studies 253. The Politics of Health Care. (Not available to undergraduates who have taken Public Policy Studies 157S.) *Sprinkle*

Public Policy Studies 256. The Economics of Health Care. Prerequisite: Economics 2D or 52D or 149 or Public Policy Studies 110. (Not available to undergraduates who have taken Public Policy Studies 157S.) *Sprinkle*

Public Policy Studies 261. Evaluation of Public Expenditures. (C-L: Economics 285.) *Staff*

Applications Courses

Food-and-Hunger Courses

One of the following may be counted:

Political Science 176A. (C-L: Interdisciplinary Course 120A.) Perspectives on Food and Hunger.

Johns

Political Science 176B. (C-L: Interdisciplinary Course 120B.) Perspectives on Food and Hunger.

Johns

Law 337. Health Care Law and Policy. (Open to limited undergraduate enrollment with consent of instructor.) *Havighurst*

*Public Policy Studies 157S. Health Policy. (May not be counted as a core course by students who have taken Public Policy Studies 253: The Politics of Health Care.) *Henderson-James*

Public Policy Studies 158S. Health Policy Summer Internship. (Must be preceded by Public Policy Studies 157S; does not count as a full course.)

Public Policy Studies 251S.01. Regulation of Vice and Substance Abuse. *Cook*

*Public Policy Studies 264S.07. Rationing Medical Care. Prerequisite: Economics 52D or 149 or Public Policy Studies 110. (May not be counted as a core course by undergraduates who have taken Economics 156.) *Lipscomb*

Public Policy Studies 264S.53. Science and Technology Policy. *Sprinkle*

Sociology 123. Social Aspects of Mental Illness. *Reed*

Sociology 163. Aging and Health. *Gold*

*Sociology 171. Comparative Health Care Systems. (Alternate years beginning fall 1993. May not be counted toward certificate if Sociology 227C is counted.) *Maddox*

Sociology 227C. Organization and Financing of Health Care. (Alternate years beginning fall 1992. May not be counted toward certificate if Sociology 171 is counted.) *Maddox*

Integrative Course

Public Policy Studies 255. Health Policy Analysis. (A group project for undergraduates only.) *CHPRE faculty*

For further information, inquire at the Center for Health Policy Research and education, Suite 125 Old Chemistry Building.

Hebrew

For courses in Hebrew, see Asian and African Languages and Literature.

Hindi-Urdu

For courses in Hindi-Urdu, see Asian and African Languages and Literature.

History (HST)

Professor Chafe, *Chair*; Professor Reddy, *Director of Undergraduate Studies*; Professors Cahow, Cell, Davis, Dirlik, Durden, Gaspar, Gavins, Goodwyn, Gordon, Herrup, Hewitt, Keyssar, Kuniholm, Lerner, Mauskopf, M. Miller, Oates, Richards, Roland, W. Scott, TePaske, Thompson, Witt, and Wood; Associate Professors English, Ewald, James, Koonz, Nathans, Neuschel, and Robisheaux; Assistant Professors French, Green, J. Scott, Thorne, and Wigen; Professors Emeriti Colton, Ferguson, Franklin, Holley, Parker, Preston, Ropp, A. Scott, Watson, and Young; Adjunct Associate Professors Roberts and

Wilson; Adjunct Assistant Professors Litle and Y. Miller; Lecturer Biddle; Adjunct Lecturer Steen

A major is available in this department.

History courses offer students from all disciplines within the University an opportunity to investigate the past, gain perspective on the present, and improve their critical faculties. History provides an integrating principle for the entire learning process, and students of history gain a sense of human development, an understanding of fundamental and lasting social processes, and a feeling for human interrelatedness. History courses train the mind by improving skills in communicating thought and imagination.

INTRODUCTORY COURSES

Students may benefit from taking at least one introductory course before proceeding to advanced-level courses. Majors take two introductory courses in history (21, 22; 21D, 22D; 21S, 22S; 53, 54; 75, 76; 91, 92; 91D, 92D; 91S, 92S or 93S); History 94 and 98 may not be used to fulfill the introductory course requirement. Additional courses may be chosen from this group as electives or part of the departmental major.

21. Europe to the Eighteenth Century. (CZ) Development and world impact of European civilization, critical evaluation of historical interpretations, and investigation of history from primary sources. One course. *Staff*

21D. Europe to the Eighteenth Century. (CZ) A lecture-discussion version of History 21. One course. *Staff*

21S. Europe to the Eighteenth Century. (CZ) A seminar version of History 21. One course. *Staff*

22. Europe from the Eighteenth Century. (CZ) Development and world impact of European civilization, critical evaluation of historical interpretations, and investigation of history from primary sources. One course. *Staff*

22D. Europe from the Eighteenth Century. (CZ) A lecture-discussion version of History 22. One course. *Staff*

22S. Europe from the Eighteenth Century. (CZ) A seminar version of History 22. One course. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

51. Introduction to Judaic Civilization. (CZ) See C-L: Religion 51; also C-L: Judaic Studies. One course. *Bland or E. Meyers*

53. Greek History. (CZ) See C-L: Classical Studies 53. One course. *Oates*

54. Roman History. (CZ) See C-L: Classical Studies 54. One course. *Oates*

75, 76. The Third World and the West. (CZ) Economic, social, political, and cultural relationships, 1500 to the present. C-L: Comparative Area Studies. One course each. *Ewald, Gordon, or Litle*

91. The Development of American Democracy to 1865. (CZ) The trends vital to an understanding of the United States today. The development of American democracy. Problems of foreign policy, the growth of capitalism, political practices, social reform, and conflicting ideals are considered in relation to this main theme. One course. *Staff*

91D. The Development of American Democracy to 1865. (CZ) A lecture-discussion version of History 91. One course. *Wilson*

91S. The Development of American Democracy to 1865. (CZ) Seminar version of History 91. One course. *Staff*

92. The Development of American Democracy, 1865 to the Present. (CZ) A continuation of History 91 with emphasis upon the emergence of contemporary problems in the United States. Students who have taken History 93S may not receive credit for History 92. One course. *Staff*

92D. The Development of American Democracy, 1865 to the Present. (CZ) A lecture-discussion version of History 92. One course. *Wilson*

92S. The Development of American Democracy, 1865 to the Present. (CZ) Seminar version of History 92. One course. *Staff*

93S. Modern American History. (CZ) Same as History 92, but emphasizing additional topics considered appropriate for the Twentieth-Century America Program (FOCUS). Open only to students in that program. One course. *Staff*

94. The Age of Augustus. (CZ) Does not count for introductory course requirements. See C-L: Classical Studies 70. One course. *Zarker*

98. Introduction to Canada. (SS) Does not count for introductory course requirements. See C-L: Interdisciplinary Course 98; also C-L: Canadian Studies, Economics 98, Political Science 98, and Sociology 98. One course. *Cahow or Thompson*

COURSES TAUGHT IN DUKE STUDY ABROAD PROGRAMS

Courses numbered 100 with a letter suffix (100A, 100B . . . 100Z) are lecture courses taught in Duke-administered study-abroad programs, for example, in Germany, Italy, France, China. These courses provide the same credit and fulfill the same curriculum requirements as any 100-level lecture course in the history department.

100A. History of Modern Spain. (CZ) (Taught in fall program in Spain.) Not open to students who have taken History 101L. One course. *Staff*

100B. History of Renaissance Italy. (CZ) (Taught in Italy.) Not open to students who have taken History 182. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Witt or staff*

100C. Nineteenth-Century European Political History. (CZ) (Taught in France.) One course. *Staff*

100E. Indian History and the Present. (CZ) Overview of medieval and modern Indian history. Emphasis on the creation of a new Indian society emerging from the colonial past. (Taught in Delhi.) One course. *Kumar*

100F. European International Relations, 1859-1914. (CZ) (Taught in France.) One course. *Staff*

100G. Twentieth-Century Economic and Social History of France. (CZ) (Taught in France.) One course. *Staff*

100H. History of France, 1860-1944. (CZ) (Taught in France.) One course. *Staff*

100I. United States/Latin American Relations, 1889-1950. (CZ) (Taught in France.) One course. *Staff*

100J. Foundations of Chinese Civilization. (CZ) (Taught in China.) Not open to students who have taken History 163. See C-L: Cultural Anthropology 163; also C-L: Comparative Area Studies. One course. *Staff*

100K. History of Spain from Late Medieval Times to the Present. (CZ) (Taught in Spain.) Not open to students who have taken History 173. One course. *Staff*

100L. German History from 1870 to 1970. (CZ, FL) Analysis of the major historical, social, economic, and cultural developments of German history, from the founding of the German Reich through the post-World War II period. (Taught in Germany by a faculty member of the Free University of Berlin.) Not open to students who have taken History 188. C-L: Comparative Area Studies. One course. *Staff*

100Q. The United States in Twentieth-Century Japan. (CZ) Particular focus on the era of American occupation of Japan. (Taught in Japan.) One course. *Gordon*

100R. History of Austria. (CZ) Austrian history from 1800-1955 including the Habsburg Monarchy, the wars against Napoleon, Metternich, the democratic revolution in 1848, the roots of World War I, the Anschluss with Nazi Germany, World War II, the Allied occupation and events after the war. Taught in English. Offered only as part of the Duke in Vienna program. One course. *Staff*

100W. History of Spain I. (CZ) Through the seventeenth century. (Taught in Spain.) One course. *Maldonado*

100X. History of Spain II. (CZ) Eighteenth to the twentieth century. (Taught in Spain.) One course. *Maldonado*

100Y-100Z. S. Modern British History: The Political Economy of Decline (1880-1980). (SS) (Taught in Oxford.) Two courses. *Staff*

UNDERGRADUATE COLLOQUIA

Colloquia are open without prerequisite to all undergraduates and are designed for the nonspecialist, although history majors may take them for credit. Each colloquium consists of reading and discussion involving an explicit historical theme. Short papers, reports, and a final examination may be required. Unlike seminars, which emphasize materials and methods of historical research, colloquia concentrate on historical literature.

101C. Terrorism, 1848-1968. (CZ) A comparative analysis of the origins and development of modern terrorism in the West (Europe, Russia, and the United States). C-L: Comparative Area Studies. One course. *M. Miller*

101G, 102G. Introduction to Islamic Civilization. (CZ) See C-L: Interdisciplinary Course 162, 163; also C-L: Comparative Area Studies; Cultural Anthropology 147, 148; Medieval and Renaissance Studies; and Religion 162, 163. One course each. *Cornell, Lawrence, and staff*

101H. Structures, Science, and Society. (CZ) The historical and scientific importance of selected structures. Monuments, buildings, bridges, and machines from Stonehenge to nuclear reactors. (Taught in summer program in London.) One course. *Mauskopf*

101K. Topics in Chinese Civilization. (CZ) C-L: Comparative Area Studies. One course. *Dirlik*

101M. Asian-Pacific Region in Historical Perspective. (CZ) The emergence of the Asian-Pacific region as a recognizable structure from the nineteenth century onward. Premodern history will be dealt with only to the extent that it is necessary for understanding later developments. The role played by the flow of commodities, people, ideas, and other cultural artifacts. C-L: Comparative Area Studies. One course. *Dirlik*

101N. The Social History of Alcohol. (CZ) The history of the consumption of alcoholic beverages as an aspect of the social history of Western Europe and the United States. One course. *Roberts*

COURSES ON SPECIAL TOPICS

Lecture Courses

Courses numbered 103 or 104 with a letter suffix (103A, 104A; 103B, 104B . . . 103Z, 104Z) are lecture courses on special topics, concerning subject matter which the department does not endeavor to cover on a routine basis. Some will be offered only once and therefore will not appear in the *Bulletin*. If such a course is likely to be offered more than once, it will be listed in the *Bulletin*.

103A. Industrialization Versus Democracy in America, 1875-1975. (CZ) The social and urban consequences of industrialization in America as the nation moved from an agrarian to an urban society and entered the modern era of mass communication. Passage of the family farm, creation of an industrial working class, centralization of commerce and of political structures, and the interaction of these processes to produce political insurgencies and cultural conflicts. The effect of the tensions upon the democratic inheritance. One course. *Goodwyn*

104A. Dissent and Revolution. (CZ) The origins and development of the varied movements that produced the political transformations in Eastern Europe and the Soviet Union in the late 1980s. The underlying dynamics of social change throughout Eastern Europe explored through Solidarnosc in Poland, Charta 77/Civic Forum in Czechoslovakia, and the civic movement in Eastern Europe. Problems faced by the people of the former communist bloc in the wake of communist rule, racial xenophobia, and religious fanaticism. Particular focus on creative and peaceful political forms. One course. *Philipsen*

104B. A Survey of Latin American History through Film. (CZ) From the colonial period to the present. C-L: Comparative Area Studies and Film and Video. One course. *TePaske*

Seminar Courses

105S, 106S. Seminars in Selected Topics. One course each. *Staff*

UNDERGRADUATE INTERMEDIATE-LEVEL COURSES

107A, 107B. History of England. (CZ) English history from 1500 to the present in an effort to arrive at a synthesis of ideas, social conditions, and political events. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course each. *Cell or Herrup*

108C. Canadian-American Relations. (CZ) The Canadian-United States relationship in its diplomatic, military, economic, and cultural aspects from the American Revolution to the present, with emphasis on the twentieth century. C-L: Canadian Studies and Comparative Area Studies. One course. *Thompson*

109. Contemporary Global Issues. (SS) See C-L: Comparative Area Studies 109; also C-L: Cultural Anthropology 109, Political Science 160, and Sociology 175. One course. *Staff*

110. History of Eastern Europe in Modern Times. (CZ) The development of the nations and nationalities of Eastern Europe since the early eighteenth century. C-L: Comparative Area Studies. One course. *Lerner*

111A. Early America to 1760. (CZ) Pre-Columbian explorations, European invasion of North America, the evolution of race slavery, and the responses of the native American peoples. Not open to students who have taken the former History 111. One course. *Wood*

111B. Era of the American Revolution, 1760-1815. (CZ) Origins, evolution, and consequences. Attention to economic, social, and geographical questions, as well as military and political. Not open to students who have taken the former History 112. One course. *Wood*

111C. The United States from the 1890s to 1940. (SS) Economic, social, and political history of the United States from the Populist revolt to the end of the New Deal. Not open to students who have taken the former History 113. One course. *Keyssar*

112A, 112B. The World in the Twentieth Century. (CZ) Imperialism and decolonization, war, revolution, international capitalism and depression, science and technology. 112A: 1900 to 1945; 112B: 1945 to present. One course each. *Cell*

113. British Society from Industrialization to Empire (1792-1914). (CZ) An overview of British history from the end of the Napoleonic wars through the outbreak of World War I. Topics include the making of the English working class and the Chartist revolt; mid-Victorian stabilization; middle-class culture, liberalism and reform; the rise of organized labor; the new imperialism and the origins of popular conservatism; and the women's movement. One course. *Thorne*

114B. Immigration, Migration, and the Mobility of Labor. (CZ) The major themes of migration, its impact on the country of departure as well as of destination, factors shaping the paths of migration, the relative openness and receptivity of countries to immigrants. Within a global framework, focus on migration and immigration to the United States, from the Irish in the 1840s to Hispanic migrants of recent decades. Case studies of migration to Latin America, migration from southern to northern Europe, and migratory movements within Asia, revealing similarities and differences in migration patterns that take place in diverse cultures and at different historical epochs. One course. *Keyssar*

115. History of Africa. (CZ) Social, political, and economic development in sub-Saharan Africa from 1400 to the present. C-L: African and Afro-American Studies 115, Comparative Area Studies, and Women's Studies. One course. *Ewald*

116. Aspects of Medieval Culture. (CZ) See C-L: Medieval and Renaissance Studies 114; also C-L: Art 139 and Classical Studies 139. One course. *Bruzelius, Solterer, and Witt*

117. Early Modern Europe. (CZ) The economic, social, and political history of early modern Europe. C-L: Comparative Area Studies, Medieval and Renaissance Studies, and Women's Studies. One course. *Neuschel*

118A. American National Security Policy from 1945 to 1975. (CZ) Evolution of American defense policy, nuclear and conventional, within the political context of the Cold War. Not open to students who have taken the former History 157. One course. *Biddle*

119A, 119B. Native American History. (CZ) A survey of conditions and events from precolonial times to the present. One course each. *Wood*

120. History of Socialism and Communism. (CZ) The origins and development of socialist and communist movements from pre-Marxian times to the present. C-L: Comparative Area Studies. One course. *Lerner*

121A. America in International Affairs, 1607-1861. (CZ) The diplomacy of the colonial, revolutionary, and early national periods. One course. *Davis*

121B. The United States as a World Power: 1861-1941. (CZ) American diplomacy from the beginning of the Civil War to entry into World War II. One course. *Davis*

121C. American Diplomacy since 1941. (CZ) Not open to students who have taken the former History 122, American Diplomacy. One course. *Davis*

122B. Japan: Population, Resources, and Development, 1600-1940. (CZ) Population pressures and environmental degradation in Japan. The long history of dense population in the Japanese archipelago, having limited agricultural lands and mineral resources. Japan's transformation, beginning in the nineteenth century, into an industrial and imperial power. The ways historians have approached this subject, focusing on debates about population control, resource management, and the social and ecological costs of Japanese modernization. One course. *Wigen*

123S. Madness and Society in Historical Perspective. (SS) Mental illness and psychiatric treatment from antiquity to the present with special concentration on the nineteenth and twentieth centuries in Europe, America, and Russia. C-L: Comparative Area Studies. One course. *M. Miller*

124S. Slave Society in Colonial Anglo-America: The West Indies, South Carolina, and Virginia. (CZ) The development of slave-based societies and the production of staple crops for export. C-L: African and Afro-American Studies 124S and Comparative Area Studies. One course. *Gaspar*

126S. Women in the Ancient World. (CZ) See C-L: Classical Studies 104S; also C-L: Women's Studies. One course. *Boatwright*

127. The Caribbean in the Eighteenth Century. (CZ) The development of Caribbean society and economy in the contexts of slavery, empire, international rivalry, and democratic revolution. C-L: African and Afro-American Studies 127. One course. *Gaspar*

128. Comparative Social Movements. (CZ) The creation or attempted creation of democratic forms in capitalist and socialist societies, using the examples of the American Populist movement and the Polish Solidarity movement as case studies. Comparison with other social movements. C-L: Comparative Area Studies. One course. *Goodwyn*

129. Experiment in Republicanism: The United States, 1787-1860. (CZ) One course. *S. Nathans*

130. From Victorian to Corporate America, 1820-1900. (CZ) One course. *S. Nathans*

131. History of Mexico and the Spanish Caribbean in the Nineteenth and Twentieth Centuries. (CZ) Political, economic, and social developments in Mexico and the Spanish Caribbean with emphasis upon comparison of the Cuban and Mexican Revolutions. C-L: Comparative Area Studies. One course. *TePaske*

132. Modern World Environmental History, 1500 to the Present. (CZ) Environmental effect of global economic growth. Impacts of agriculture, forestry, mining, and industry on the biosphere. Use of freshwater resources. Effects of modern transportation and urbanization. The world environmental movement. C-L: Comparative Area Studies. One course. *Richards*

133. Medieval Europe, 300-1400. (CZ) C-L: Medieval and Renaissance Studies. One course. *Staff*

134. Medieval England. (CZ) From the fifth through the fourteenth centuries. C-L: Medieval and Renaissance Studies. One course. *Staff*

135A. Germany from the Thirty Years' War to Unification in 1871. (CZ) The development of nationalism among a people living in over 300 states; social change in an economically backward setting; and revolution in a Romantic context. C-L: Comparative Area Studies. One course. *Koonz*

135B. Germany from 1871 to 1933. (CZ) Militarism, socialism, and feminism following the first unification; Weimar democracy in the aftermath of defeat; the popularity of Hitler in the context of the Depression. C-L: Comparative Area Studies. One course. *Koonz*

135C. Germany from 1933 to 1990. (CZ) The creation of the Nazi state, its propaganda, economic recovery schemes, and bio-political social organization. The war years, from the standpoint of the victims and perpetrators, to be examined through memoirs and psychological studies of the "holocaust kingdom." The postwar period: women's role in rebuilding Germany, de-Nazification and the Cold War in the East and West, and (based on journalists' accounts) "post-wall" Germany. The shape of public memory in "Bitburg history" and monuments to the victims of Nazi extermination. One course. *Koonz*

136. Introduction to Contemporary Latin American Reality. (CZ) The complexity and diversity of factors which help to define the daily experience of Latin American reality for contemporary Latin Americans. Through cultural, academic, and government documents, issues ranging from ecology and energy policy in Brazil to human rights abuses and the experience of women in modern Latin America will be studied. One course. *James*

137. Strategies of Comparative Analysis. (SS) See C-L: Comparative Area Studies 125; also C-L: Cultural Anthropology 125, Political Science 125, Religion 121, and Sociology 125. One course. *Staff*

138. Renaissance and Reformation Germany. (CZ) The interplay of social, economic, and political developments in Central Europe from the eve of the Reformation to the end of the Thirty Years' War, with particular attention to the links between religion, gender, and the social order. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Robisheaux*

139. China since 1949: The People's Republic. (CZ) The Chinese path to communism and the communist transformation of Chinese society. C-L: Comparative Area Studies. One course. *Dirlik*

140S. Economics of Slavery in the American South. (SS) Prerequisite: Economics 149. See C-L: Economics 161S; also C-L: African and Afro-American Studies 161S. One course. *Coats*

141S. American Light. (CZ) The stories, poems, and essays of Raymond Carver and the paintings of Edward Hopper as a means of thinking about the social history of America's twentieth-century working-class people. One course. *Coles*

142. China: Roots of Revolution. (CZ) A survey of modern Chinese history with special emphasis on the nineteenth and twentieth centuries. C-L: Comparative Area Studies. One course. *Dirlik*

143A. Ancient and Early Modern Japan. (CZ) Japan from earliest settlement to 1868; the Heian Court, rise of the samurai, feudal society and culture, the Tokugawa age, and the Meiji Restoration. Not open to students who have taken the former History 143. C-L: Comparative Area Studies. One course. *Gordon*

143B. The Emergence of Modern Japan. (CZ) Japan from Meiji to microchips. The Meiji settlement, industrialization and urban growth; political parties, social movements, and foreign policy in the imperial era; World War II and the American occupation; economic recovery. Not open to students who have taken the former History 144. C-L: Comparative Area Studies. One course. *Gordon*

144. Introduction to Latin American Politics. (SS) See C-L: Political Science 151; also C-L: Comparative Area Studies. One course. *Archer*

145A, 145B. Afro-American History. (CZ) The black experience in America from slavery to the present. C-L: African and Afro-American Studies 145A, 145B and Comparative Area Studies. One course each. *Gavins*

146. Introduction to Russian Civilization. (CZ) See C-L: Russian 190; also C-L: Comparative Area Studies. One course. *Pelech*

147. Technology and War. (SS) The technology of war from earliest times to the present, with emphasis on Western experience. One course. *Roland*

148. Aspects of Renaissance Culture. (CZ) See C-L: Medieval and Renaissance Studies 115; also C-L: Art 149. One course. *L. Patterson, Rasmussen, Van Miegroet, and Witt*

149. Military History. (CZ) War, politics, and technology. One course. *Roland*

150. Flight and the Twentieth Century: From Kitty Hawk to Challenger. (CZ) The history of flight in the atmosphere and in space, with emphasis on the United States. Covers social, technical, political, and economic issues; no technical background necessary. One course. *Roland*

151A. The Intellectual Life of Europe, 1250–1600. (CZ) Not open to students who have taken History 104. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Witt*

152. The Modern Middle East. (CZ) The historical development of the Middle East in the nineteenth and twentieth centuries. The emergence of nation-states in the region following World War I. C-L: Comparative Area Studies. One course. *Y. Miller*

153. The Insurgent South. (CZ) One course. *Goodwyn*

154D. The French Revolution at 200 Years. (CZ) The uncertainties that still surround historical interpretations of this seminal event. One course. *Reddy and Stewart*

156A. The Reformation of the Sixteenth Century. (CZ) See C-L: Religion 167. One course. *Hillerbrand*

157A, 157B, 157C. The Rise of Modern Science. (CZ) The development of science and medicine, with attention to cultural and social influences upon science. 157A: through Newton. 157B: eighteenth to twentieth centuries. 157C: twentieth century. History 157C not open to students who have taken the former History 118, Science in the Twentieth Century. One course each. *Green and Mauskopf*

158A. New Perspectives on the Atlantic World. (CZ) Reorients the histories of four continents. An exploration of how an Atlantic world arose because of the interactions among Africa, North America, South America, and Europe. How this Atlantic world originated in the fifteenth century; how people emigrated, by force or free will, from one continent to another (and often back again); how plants, animals, trade goods, and diseases crossed the ocean; how ideas—especially revolutionary ideas—arose from intercontinental contact and spread throughout the Atlantic world. Concludes that

people of each of the Atlantic continents possess a heritage including the three other continents, and that this heritage was ocean-borne. One course. *Ewald*

159S. The Palestine Problem and United States Public Policy. (CZ) See C-L: Public Policy Studies 175S; also C-L: Comparative Area Studies. One course. *Kuniholm*

160. The United States from the New Deal to the Present. (CZ) C-L: Women's Studies. One course. *Chafe*

161. History of Modern Russia. (CZ) Following a brief introduction to the medieval origins of the Imperial Russian state, the course will concentrate on the period between the reign of Catherine the Great (1762-1796) and the death of Lenin in 1924. Emphasis on state authority, ruling elites, and the formation of the opposition revolutionary movement leading to the Bolshevik seizure of power in 1917. Not open to students who have taken both History 161A and 161B. C-L: Comparative Area Studies. One course. *M. Miller*

162A. Diplomatic Relations in the Western Hemisphere. (CZ) Relations between Latin America and the United States from 1815 through the 1960s with special emphasis on Mexico, Central America, and the Caribbean. The eras of Manifest Destiny, Dollar Diplomacy, the Cold War, and the Cuban Revolution as seen through the biography and discourse of participants and historians. One course. *French*

163A. The Coming of the United States' Civil War, 1820-1860. (CZ) Slavery and the gradual collapse of the early national consensus concerning it. The rise of sectionalism as reflected mainly in the nation's politics. One course. *Durden*

163B. The United States' Civil War and its Aftermath, 1861-1900. (CZ) Emphasis on the political and social aspects of the war; only slight treatment of battles. Political, racial, and economic themes of the Reconstruction and Populist eras. One course. *Durden*

164. India, Pakistan, and Bangladesh: 1750 to the Present. (CZ) Social and economic impact of Western rule, development of nationalism and independence. C-L: Comparative Area Studies. One course. *Richards*

165. Working Class History in the United States. (CZ) A social history of the working class, as well as a political history of labor, from the early nineteenth century to the present. Not open to students who have taken History 106. One course. *Keyssar*

166S. American Dreams, American Realities. (CZ) The role of such myths as "rags to riches," "beacon to the world," the "frontier," and the "foreign devil" in defining the American character and determining the hopes, fears, dreams, and actions of people throughout American history. One course. *Wilson*

167S. United States and Canadian Constitutional Issues. (CZ) A comparative study of the development of federalism. C-L: Canadian Studies and Comparative Area Studies. One course. *Cahow*

168S. The Atlantic Slave Trade. (CZ) The development of the slave trade from the fifteenth century to its abolition in the nineteenth century; organization and mechanics, impact on Europe, Africa, and the Americas. C-L: African and Afro-American Studies 168S and Comparative Area Studies. One course. *Gaspar*

169A, 169B. The Social History of American Women. (CZ) C-L: Women's Studies. One course each. *Hewitt*

170C. Brazilian Race Relations in Comparative Perspective. (CZ) Slavery and the post-emancipation trajectory of Afro-Brazilians in a racist society which officially proclaims itself a "racial democracy." Comparisons will be drawn with the Afro-American

experience elsewhere in Latin America and the United States. C-L: African and Afro-American Studies 170. One course. *French*

171A. History of Women in Early Modern Europe. (CZ) Women in Europe from medieval times to 1800 with attention to economic, social, and intellectual experience. C-L: Comparative Area Studies and Women's Studies. One course. *Neuschel*

171B. History of Women in Modern Europe. (CZ) History of women in Europe since 1700 with attention to economic, social, and intellectual experience. C-L: Comparative Area Studies and Women's Studies. One course. *Koonz*

172. Nineteenth- and Twentieth-Century Argentina and Brazil. (CZ) The social, cultural, and political history of nineteenth- and twentieth-century Argentina and Brazil, and the impact of the change from rural to urban and industrial societies on the political and social structures of the two nations. One course. *James*

173. History of Spain from Late Medieval Times to the Present. (CZ) Development of the Spanish nation-state from the times of Ferdinand and Isabella, Charles V, and Philip II to the Franco regime and its aftermath. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *TePaske*

174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence. (CZ) The pre-Columbian cultures, European conquest and its effects on the Amerindian peoples, and development of the Spanish and Portuguese Empires to the wars of independence, with special emphasis upon colonial institutions and socioeconomic developments. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *TePaske*

175S. The Southern Plantation as Historical Laboratory: Odyssey in Black and White, 1770-1970. (CZ) Readings and discussion on the plantation as a microcosm of Southern social history since 1770, emphasizing the parallel evolution of black and white communities, families, economies, cultures, perceptions, and power struggles. C-L: African and Afro-American Studies 175S. One course. *Nathans*

176S. The Southern Plantation as Historical Laboratory: Research Seminar. (CZ) Original research projects and seminar discussions on the social history of the plantation and its black and white inhabitants, relying on manuscripts at Duke and at the Southern Historical Collection, statistical records, the architectural legacy, literary and oral testimony, material culture, and folklore. C-L: African and Afro-American Studies 176S. One course. *Nathans*

177. Modern Latin America. (CZ) A survey of nineteenth- and twentieth-century economic, social, and cultural change. C-L: Comparative Area Studies. One course. *Staff*

179. History of South Africa, 1600-1960. (CZ) The relationships among South Africa's racial and cultural communities, with special attention to economic and political developments within each community and the impact of those developments on their mutual interactions. C-L: African and Afro-American Studies 179 and Comparative Area Studies. One course. *Ewald*

180. The Soviet Experience. (CZ) A survey of the history of Russia and the Soviet Union from the eve of the Revolution to the present day with particular emphasis on political, social, and cultural change and continuity. Not open to students who have had History 262. C-L: Comparative Area Studies. One course. *Lerner*

181. Alexander the Great. (CZ) See C-L: Classical Studies 135. One course. *Oates*

182C. History of Greek and Roman Civil Law. (CZ) Not open to students who have taken History 103. See C-L: Classical Studies 102. One course. *Oates*

183S. Canada from the French Settlement. (CZ) Problems in the development of Canada and its provinces. C-L: Canadian Studies and Comparative Area Studies. One course. *Cahow or Thompson*

184S. Canadian Issues. (SS) Prerequisite: Interdisciplinary Course 98 or consent of instructor. See C-L: Interdisciplinary Course 184S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 184S, Economics 184S, Political Science 184S, and Sociology 184S. One course. *Cahow or Thompson*

185. American Diplomacy from the Kennedy Administration to the Present. (SS) C-L: Public Policy Studies 185. One course. *Davis or Kuniholm*

186. Marxism and Society. (SS) See C-L: Cultural Anthropology 139; also C-L: Comparative Area Studies, Education 139, Interdisciplinary Course 139, and Sociology 139. One course. *Wilson*

187. History and Religions of North Africa. (CZ) See C-L: Religion 164; also C-L: African and Afro-American Studies 164, Comparative Area Studies, and Interdisciplinary Course 164. One course. *Cornell or Lawrence*

189. Medicine in the West. (CZ) Concepts of disease, the social context of the delivery of medical care, and the standing of physicians in society. The relation between medical theory and medical practice. One course. *Green*

190. The History of Women in Science and Medicine. (CZ) The history of scientific and medical theories about women and an analysis of women as participants in the evolution of science and medicine. One course. *Green*

193, 194. Introduction to the Civilizations of Southern Asia. (CZ) See C-L: Interdisciplinary Course 101, 102; also C-L: Asian and African Languages and Literature 160, 161; Comparative Area Studies; Cultural Anthropology 101, 102; and Religion 160, 161. One course each. *Khanna or staff*

SMALL GROUP LEARNING EXPERIENCES

Independent Study

Independent study is usually undertaken by students concurrently with a course or with an instructor with whom they have had a course. Students should submit to the instructor in writing a detailed description of intent in the study. Both the instructor's consent and approval of the Director of Undergraduate Studies are required for enrollment.

191, 192. Independent Study. One course each. *Staff*

Undergraduate Seminars

See also History 21S, 22S, 49S, 91S, 92S, 93S, 105S, 106S, 123S, 124S, 140S, 141S, 159S, 166S, 167S, 168S, 175S, 176S, 183S, 184S.

195S, 196S. Seminars for Undergraduates. Opportunities for historical investigation of significant problems. Juniors as well as seniors may apply for admission to these courses and are urged to do so if they expect to be candidates for graduation with distinction in history or if they expect to practice-teach in their senior year. Open to majors and nonmajors. The sections are listed below. One course each. *Staff*

Courses with an asterisk are offered for year-long study and carry two course credits. For these courses students may obtain the instructor's permission to enroll in only one semester and receive credit. Courses without an asterisk are one semester courses and carry one course credit each.

2. Reform, Protest, and Social Change in the Nineteenth-Century United States. (CZ) *Nathans*

*3. Problems in the Social and Intellectual History of the United States. (CZ) *Staff*

- *4. Medicine and Society in America. (CZ) *English*
5. Japanese Women's History. (CZ) C-L: Women's Studies. *Wigen*
- *6. The Era of the American Civil War, 1820-1900. (CZ) *Durden*
7. Religion and Society in Modern British History. (CZ) *Thorne*
- *8. Modern Chinese Thought. (CZ) C-L: Comparative Area Studies. *Dirlik*
9. Issues in Early Modern Japanese Development. *Wigen*
10. History of Jews in Eastern Europe in Modern Times. *Lerner*
11. Europe and the World since 1914. (CZ) C-L: Comparative Area Studies. *W. Scott*
12. Europe and the World since 1939. (CZ) C-L: Comparative Area Studies. *W. Scott*
13. Problems in Early Modern English History. (CZ) C-L: Comparative Area Studies and Medieval and Renaissance Studies. *Herrup*
14. Social Movements in the American South, 1865-1970. (CZ) *Goodwyn*
15. Society and Polity in France, 1700 to the Present. (SS) C-L: Comparative Area Studies. *Reddy*
16. Science and Society. (CZ) *Mauskopf*
- *17. Problems in the History of Modern Japan. (CZ) C-L: Comparative Area Studies. *Gordon*
18. The Destruction and Aftermath of Slavery in the Americas: A Comparative Perspective. (CZ) C-L: Afro-American Studies 197S and Comparative Area Studies. *J. Scott*
19. Social Conflict and Political Change in the United States, 1789-1860. (SS) *Nathans*
20. The Asian-American Experience. (SS) *Dirlik*
21. Problems in Indian History. C-L: Comparative Area Studies. (SS) *Richards*
- *22. Problems in Latin American History. (SS) C-L: Comparative Area Studies. *TePaske*
23. Issues in the History of Tropical Africa. (SS) C-L: African and Afro-American Studies 196S and Comparative Area Studies. *Ewald*
- *24. Problems in Recent United States Diplomatic History. (CZ) *Davis*
25. Problems in Twentieth-Century American History. (SS) *Chafe*
26. State and Society in the Third Reich. (CZ) *Koonz*
27. Origins of the Cold War. (SS) *Kuniholm*
28. The Spanish Civil War and Its Aftermath. (CZ) *TePaske*
29. Proletarians and Peasants, Bandits and Prophets: Social Movements in Nineteenth- and Twentieth-Century Latin America. (CZ) *James*
30. Problems in Russian History. (CZ) C-L: Comparative Area Studies. *M. Miller*
31. History and Memory of Nazi Genocide. (CZ) *Koonz*
32. Crime and Society: Changing Definitions of Criminality in England and America. (SS) *Herrup*
33. Political Participation in the United States. (SS) *Keyssar*
34. Problems in Imperialism. (CZ) *Cell*
35. Palestine and the Arab-Israeli Conflict. (CZ) C-L: Comparative Area Studies. *Y. Miller*
36. State Formation in Global Perspective: the Impact on Women and Families. (CZ) C-L: Comparative Area Studies. *Y. Miller*
37. Before Columbus: Western Views of the Non-Western World. (CZ) *Green*
38. The Costs of Industrialization. (CZ) *Goodwyn*
40. Fugitive Slave (Maroon) Communities in New World Slave Societies. (CZ) C-L: African and Afro-American Studies 195S and Comparative Area Studies. *Gaspar*
41. Women in Medieval Society. (CZ) C-L: Women's Studies. *Green*
42. The American Indian in the Revolutionary Era. (CZ) *Wood*
- *43. The Transition from Rural to Urban Society. (CZ) *A. Scott*
44. Popular Patriotism in Modern British History. (CZ) *Thorne*
45. Canadian and American Agrarian Movements. (SS) C-L: Canadian Studies. *Thompson*
48. History of Witchcraft and Magic: Antiquity to 1700; 1700 to Present. (CZ) *Robisheaux*
50. The Women's Movement in the United States. (CZ) C-L: Women's Studies. *Hewitt*
54. Community Service and Documentary Tradition. (CZ) C-L: Public Policy Studies 195S.27. *Coles and Harris*
57. Middle East Conflict and United States Policy. (CZ) *Kuniholm*
58. On Revolutions. (CZ) *Philipsen*
59. History of Zionism and the State of Israel. (CZ) *Y. Miller*

Honors Seminars

197S-198S. Senior Honors Seminar. Designed to introduce qualified students to advanced methods of historical research and writing and to the appraisal of critical historical issues. Open only to seniors, but not restricted to candidates for graduation with distinction. This course, when taken by a history major, is accompanied by either a year-long 195S-196S seminar or two courses at the 200 level. In unusual circumstances, with consent of the instructor, coordinator of the senior honors seminar, and Director of Undergraduate Studies, 191-192 may replace the two courses of 195S-196S seminars or the two courses at the 200 level. Two courses. *Staff*

ADVANCED COURSES (FOR SENIORS AND GRADUATES)

Students may receive credit for either semester of a hyphenated course at the 200 level without taking the other semester if they obtain written consent from the instructor.

201S. The Russian Intelligentsia and the Origins of the Revolution. (CZ) Origin and dynamics of the Russian revolutionary movement, the intelligentsia, and the emergence of the labor movement. C-L: Comparative Area Studies. One course. *M. Miller*

202S. The Russian Revolution. (CZ) An analysis of the Bolshevik seizure of power in 1917 and the establishment of a revolutionary society and state during the 1920s. C-L: Comparative Area Studies. One course. *M. Miller*

203. Topics in Modern World Environmental History. (CZ) Human effects upon the natural environment; case studies and a synthetic global perspective. One course. *Richards*

204. German Society, 1914-1945. (CZ) Investigation of daily life at the grass roots, demographic shifts, organizational activity, ethnic conflict, political mobilization, and generational conflicts. One course. *Koonz*

205S. Gender and War. (CZ) See C-L: Interdisciplinary Course 205S; also C-L: Asian and African Languages and Literature 205S. One course. *Cooke and Roland*

206. Origins of Afro-America. (CZ) A comparative and interdisciplinary approach to early history of Africans in the Western hemisphere. Uses anthropological, linguistic, and archeological literature in addition to historical studies to examine the origins of the diverse African-American cultures of the Americas. C-L: African and Afro-American Studies 206. One course. *J. Scott*

207S. Geographic Perspectives in History I: Western Europe and the Americas. (SS) Connections between history and geography. Regional, spacial, and environmental analyses of social development in Western Europe and the Americas. One course. *Wigen*

208S. Geographic Perspectives in History II: Asian and Pacific Worlds. (SS) Connections between history and geography. Regional, spacial, and environmental analyses of social development in Asia and the Pacific region. C-L: Comparative Area Studies. One course. *Wigen*

209S. Race, Class, and Gender in Modern British History. (CZ) The intersection between gender, race, and class identities in British history since the eighteenth century. The parallels and overlaps as well as the disjunctures and distinctions between these different modes of power in a period of tremendous economic, social, and political change resulting from industrialization and imperial expansion. Questions and issues include the impact of industrialization on gender as well as class consciousness, the role of women, the middle classes and the working classes in the campaign against slavery, British workers' reactions to the "scramble" for colonies, the attitudes and activities of British women in the empire, and sexuality and the evolution of racialist discourse. One course. *Thorne*

210S. Anthropology and History. (SS) Prerequisite: major in history, one of the social sciences, or comparative area studies; or graduate standing. See C-L: Cultural Anthropology 207S. One course. *Reddy*

213S. Early Modern France. (CZ) Intensive survey of French history from approximately 1500-1750, including political, social, religious, and economic history. Focuses

on interpretive trends in historiography and links between cultural history and literature. One course. *Neuschel*

214. Class, Public Opinion, and the French Revolution. (CZ) The current state of the ongoing controversies over the origins and character of the first modern social revolution. One course. *Reddy*

215S. The United States in International Relations: The Eighteenth and Nineteenth Centuries. (CZ) C-L: Canadian Studies. One course. *Davis*

216S. United States Diplomacy, 1890-1945. (CZ) C-L: Canadian Studies. One course. *Davis*

217. Problems in American Colonial History. (CZ) One course. *J. Scott*

218S. Perspectives on the Atlantic World. (CZ) One course. *Ewald*

219S, 220S. History of Science and Technology. (CZ) The interaction of science and technology in the Western world from earliest times to the present. One course each. *Mauskopf and Roland*

221. Topics in the Social and Economic History of Europe, 1200-1700. (CZ) C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Staff*

222. Problems in the Intellectual History of the European Renaissance and Reformation. (CZ) Prerequisites: History 151A, 151B and reading knowledge of German, French, or Italian. C-L: Medieval and Renaissance Studies. One course. *Witt*

223S, 224S. The World Wars. (CZ) The causes, course, and consequences of World Wars I and II, from military, political, and economic perspectives; the legacy of World War II; special emphasis on understanding the experience of total war—not only for the individual soldier but for whole societies. One course each. *Biddle*

225S. Problems in Comparative Labor History. (SS) Common dilemmas and varying solutions in the cross-national development of labor-management relations, their political implications, and their larger historical significance. One course. *Gordon, Keyssar, or Reddy*

226. Topics in the Labor History of the United States. (SS) One course. *Keyssar*

227-228. Recent United States History: Major Political and Social Movements. (CZ) C-L: Women's Studies. Two courses. *Chafe*

230S. Populism in Latin America. (CZ) An examination of the various theoretical frameworks developed for Latin American populism, followed by case studies focusing on issues such as the emergence of a modernizing state, the role of the masses in populist movements, and the class content and ideological and cultural parameters of such movements. One course. *James*

231S. Readings in Latin American Colonial History. (CZ) C-L: Comparative Area Studies. One course. *TePaske*

233S. Slave Resistance and Social Control in New World Societies. (CZ) The operation of slave societies in the Americas from the sixteenth to the nineteenth centuries focusing on master-slave relations and slave resistance. C-L: African and Afro-American Studies 233S and Comparative Area Studies. One course. *Gaspar*

234S. Political Economy of Development: Theories of Change in the Third World. (SS) See C-L: Political Science 234S; also C-L: Comparative Area Studies, Cultural Anthropology 234S, Interdisciplinary Course 234S, and Sociology 234S. One course. *Staff*

235S. The Antebellum South. (CZ) The economic, political, and social aspects of life in the South, 1820-1860. One course. *S. Nathans*

237S. Europe in the Early Middle Ages. (CZ) C-L: Medieval and Renaissance Studies. One course. *Staff*

238S. Europe in the High Middle Ages. (CZ) C-L: Medieval and Renaissance Studies. One course. *Staff*

239S. History of Socialism and Communism. (CZ) Problems in the origins and development of socialist and communist movements. C-L: Comparative Area Studies. One course. *Lerner*

241S-242S. United States' Constitutional History. (CZ) 241S: to 1865; 242S: 1865 to present. Two courses. *Cahow*

243-244. Marxism and History. (SS) Critical examination of Marxist theory and its relevance to historical understanding and explanation. C-L: Comparative Area Studies. Two courses. *Dirlik*

245, 246. Social and Intellectual History of China. (CZ) C-L: Comparative Area Studies. One course each. *Dirlik*

247. History of Modern India and Pakistan, 1707-1857. (CZ) C-L: Comparative Area Studies. One course. *Richards*

248. History of Modern India and Pakistan, 1857 to the Present. (CZ) C-L: Comparative Area Studies. One course. *Richards*

249-250. Social and Intellectual History of the United States. (CZ) The interplay of ideas and social practice through the examination of attitudes and institutions in such fields as science and technology, law, learning, and religion. Two courses. *Holley*

251A. Topics in Intellectual History of Europe, 1250-1450. (CZ) C-L: Medieval and Renaissance Studies. One course. *Witt*

251B. Topics in Intellectual History of Europe, 1450-1650. (CZ) C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Witt*

252. Construction of China in European and American Literature. (CZ) An examination, starting with Marco Polo's account of China, of representations of China in Euro-American writing toward an understanding of a Euro-American discourse on China. Emphasis on fiction, but consideration as well of the relationship between fictional and nonfictional writing (especially history, geography, and travelogue). While the approach is historical, contemporary representations of China are of primary concern. One course. *Dirlik*

253S, 254S. European Diplomatic History, 1871-1945. (CZ) Origins of the First and Second World Wars, the diplomacy of the wars, and the peace settlements which followed them. 253S: 1871-1918; 254S: 1919-1945. C-L: Comparative Area Studies. One course each. *W. Scott*

256. Modern Literature and History. (AL) See C-L: French 256. One course. *Orr*

257. Comparative Latin America Labor. (CZ) An interdisciplinary examination of the monographic literature on Latin-American labor in the twentieth century. One course. *French*

258S. Social Conflict in Weimar and Nazi Germany. (CZ) The interactions between emancipation and backlash; military defeat and patriotism; political equality and bio-

politics; dissent and repression; and among propaganda, bureaucratic chaos, and police terror. C-L: Comparative Area Studies. One course. *Koonz*

259. Archaic Greece. (CZ) See C-L: Classical Studies 221. One course. *Oates or Rigsby*

260. Fifth and Fourth Century Greece. (CZ) See C-L: Classical Studies 222. One course. *Oates or Rigsby*

261. Alexander and the Hellenistic World. (CZ) See C-L: Classical Studies 223. One course. *Oates*

262. Problems in Soviet History. (CZ) Studies in the background of the Revolution of 1917 and the history and politics of the Soviet state. C-L: Comparative Area Studies. One course. *Lerner*

263. The Roman Republic. (CZ) See C-L: Classical Studies 224. One course. *Boatwright or Rigsby*

264. The Roman Empire. (CZ) See C-L: Classical Studies 225. One course. *Boatwright*

265S. Problems in Modern Latin American History. (SS) C-L: Comparative Area Studies. One course. *Staff*

267S. England in the Sixteenth Century. (CZ) C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Herrup*

268S. England in the Seventeenth Century. (CZ) C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Herrup*

269S-270S. British History, Seventeenth Century to the Present. (CZ) Historiography of social structure and social change: English Revolution, party, the Industrial Revolution, class and class consciousness, Victorianism, and the impact of war in the twentieth century. C-L: Comparative Area Studies. Two courses. *Cell*

273S, 274S. Topics in the History of Science. (CZ) Critical stages in the evolution of scientific thought. One course each. *Mauskopf*

277S. The Coming of the Civil War in the United States, 1820-1861. (CZ) One course. *Durden*

278S. The Civil War in the United States and Its Aftermath, 1861-1900. (CZ) One course. *Durden*

279, 280. Health, Healing, and History. (CZ) The development of medicine within the broader cultural context from prehistory to the twentieth century. One course each. *English*

281S. United States' Diplomacy since 1945. (CZ) C-L: Canadian Studies. One course. *Davis*

282S. Canada. (SS) A research seminar for advanced students familiar with Canada. Topics vary each semester; recent perspectives have included nationalism, Canadian-American relations, regionalism in the Maritimes and the West, and cross-border environmental issues, among others. C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Economics 282S, Interdisciplinary Course 282S, Political Science 282S, and Sociology 282S. One course. *Cahow or Thompson*

285S, 286S. Oral History. (SS) Research on race relations and civil rights in the United States in the twentieth century using techniques of oral history. Consent of instructor required. One course each. *Chafe and Goodwyn*

287S. History and Social Theory. (CZ) Contemporary theories of social order, social change, and revolution. One course. *Goodwyn*

Upperclassmen-Graduate Seminars

See History 201S, 202S, 207S, 208S, 210S, 215S, 216S, 219S, 220S, 225S, 230S, 233S, 235S, 237S, 238S, 239S, 241S, 242S, 253S, 254S, 258S, 265S, 267S, 268S, 269S-270S, 273S, 274S, 277S, 278S, 281S, 282S, 285S, 286S, 287S.

COURSES CURRENTLY UNSCHEDULED

100M-100N. Roman and Non-Roman in Ancient Italy. (CZ)

125. Religion in Greece and Rome. (CZ)

156B. Religion and Society in Early Modern Europe. (CZ)

178. Science and Technology in the Ancient World. (CZ)

212. The American Indian in the Revolutionary Era, 1760-1800. (CZ)

266. Late Antiquity. (CZ)

HISTORY COURSES BY FIELDS

History courses for undergraduates are offered in five fields, as noted below; students majoring in the department must complete at least one course in each of three fields. A course listed in two fields may be used to meet the requirement in either of those fields, but may not be used for both.

Africa, Asia, Canada, Caribbean, Latin America, Russia. History 75, 76, 98, 101C, 100E, 100I, 100J, 101G, 101K, 101M, 102G, 104B, 108C, 109, 110, 112A, 112B, 115, 120, 123S, 124S, 127, 128, 131, 132, 136, 139, 142, 143A, 143B, 144, 146, 152, 158A, 159S, 161, 162A, 164, 167S, 168S, 170C, 172, 174, 177, 179, 180, 183S, 184S, 186, 187, 193, 194; 195S, 196S sections S, 8, 9, 17, 18, 20, 21, 22, 23, 29, 30, 34, 35, 40, 45, S7, S9; 201S, 202S, 208S, 210, 230S, 231S, 233S, 239S, 243, 244, 24S, 246, 247, 248, 262, 265S, 282S.

Ancient, Medieval and Renaissance. History 21, 21D, 21S, 51, 53, 54, 94, 100B, 100K, 107A, 116, 117, 125, 126, 133, 134, 138, 148, 151A, 156A, 173, 178, 181, 182C; 195S, 196S sections 13, 39, 41, 48; 221, 222, 237S, 238S, 251A, 251B, 260, 261, 263, 264, 266, 267S, 268S.

Medicine, Military, Science, Technology. History 101H, 123S, 132, 147, 149, 150, 157A, 157B, 157C, 163A, 163B, 178, 189, 190; 195S, 196S sections 4, 16, 58; 203S, 205S, 208S, 219S, 220S, 223S, 224S, 273, 274, 279, 280.

Modern Europe. History 21, 21D, 21S, 22, 22D, 22S, 100A, 100C, 100F, 100G, 100H, 101C, 101H, 101N, 107A, 107B, 109, 110, 112A, 112B, 113, 117, 120, 123S, 128, 135B, 135C, 137, 138, 154D, 156B, 158A, 171A, 171B, 173, 180; 195S, 196S sections 7, 10, 11, 12, 13, 15, 26, 28, 31, 32, 34, 48; 204, 207S, 214, 221, 222, 239, 253S, 254S, 256, 258S, 268S, 269S, 270S.

United States. History 91, 91D, 91S, 92, 92D, 92S, 93S, 100I, 100Q, 101C, 101N, 108C, 111A, 111B, 111C, 114B, 121A, 121B, 121C, 123S, 124S, 128, 129, 130, 140S, 141S, 145A, 145B, 150, 153, 157, 158A, 159S, 160, 162A, 163A, 163B, 165, 166S, 167S, 168S, 169A, 169B, 170C, 175S, 176S, 18S; 195S-196S sections 2, 3, 4, 6, 14, 18, 19, 20, 24, 25, 27, 32, 33, 38, 42, 43, 45, 57; 206, 212, 215S, 216S, 217, 225, 226, 227, 228, 235, 241S-242S, 249-250, 277S, 278S, 281S, 285S, 286S, 287S.

THE MAJOR

Introductory Courses. Two introductory courses in history (21, 22; 21D, 22D; 21S, 22S; 51, 53, 54; 75, 76; 91, 92; 91D, 92D; 91S, 92S; 93S).

Major Requirements. Eight courses in history including (1) at least two introductory courses (History 94 and 98 do not fulfill this requirement), (2) at least one course in each of three out of the five fields described above, (3) two courses in an undergraduate seminar (195S, 196S) or on the 200 level. Some of the courses at this level are two-semester sequences; a few of these require the student to take both semesters in order to get a

grade. Except for these few cases, students are not required to take both semesters of two-semester courses.

Advanced Placement Credit. Two of the eight courses needed for the major may be fulfilled by advanced placement credits. If two additional advanced placement credits have been granted they may be applied toward the thirty-four credits needed for graduation, but may not be applied to the history major.

Transfer Credit. At least six of the eight courses required for the history major must be taken at Duke. Exceptions to this rule may be made for students with Advanced Placement Credit who also study abroad while at Duke. In such instances, two Advanced Placement credits and two credits from a study abroad program may apply toward the eight courses required for the major.

Foreign Languages. Majors interested in a particular area of study benefit from knowledge of the language of that area. Majors who contemplate graduate work are reminded of the requirement of a reading knowledge of one or two foreign languages.

Majors Planning to Teach. Majors who plan to teach in secondary schools should consult an advisor in education. Rising juniors who intend to practice-teach in the senior year should take the 195S-196S or 197S-198S seminars or 200-level courses as juniors.

Honors/Distinction. Any student who is qualified (see the section on honors in this bulletin) may apply to the Director of Undergraduate Studies for permission to undertake work leading to a degree with distinction in history.

House Courses (HC)

See the chapter "Academic Procedures and Information" for information on house courses.

Human Development Program

Professor Maddox, *Director*

A certificate, but not a major, is available in this program.

The goal of this interdisciplinary program is to broaden and enhance the perspectives of students interested in human development. The program seeks to foster an understanding and appreciation of how biological, psychosocial, and cultural factors act together in development throughout the life course; highlight the ways in which different disciplines conceptualize and study development; demonstrate the complementarity of disciplinary perspectives; and facilitate dialogue among faculty and students, illustrating the complementarity of and necessity for multidisciplinary perspectives.

Achievement of the program's goal is facilitated by an integrated curriculum of required and elective courses, a research apprenticeship, a lecture series, and other special events. An active advisory procedure assists students in planning learning opportunities. A certificate is available for students who complete program requirements. Participation in selective parts of the program and in the advisory system, however, is available to all undergraduates whether or not they seek the certificate.

The curriculum includes six courses, completion of which is required for the program certificate:

Interdisciplinary Course 124. Human Development. C-L: Psychology 124 and Sociology 124. *N.*

Anderson and staff

Either Psychology 159S (Biological Psychology of Human Development, *Thompson*) or Interdisciplinary Course 180, C-L: Psychology 130 and Sociology 169 (Psychosocial Aspects of Human Development, *Martin Lakin and Maddox*)

Interdisciplinary Course 190. Research Apprenticeship in Human Development. *Maddox and staff*

Interdisciplinary Course 191S. Senior Seminar in Human Development. *Thompson and staff*

Two elective courses chosen from an illustrative list of biological, psychological, and social scientific courses affiliated with the program published in the program brochure. This list of elective courses includes Interdisciplinary Course 192S (Special Topics in Human Development).

The research apprenticeship arranged through the program and the related senior seminar would ordinarily be available only to students seeking the program certificate. Other components of the program are available to all undergraduates.

Immunology (IMM)

For courses in Immunology, see Medicine (School)—Graduate (School) Basic Science Courses Open to Undergraduates.

Interdisciplinary Courses (IDC)

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

98. Introduction to Canada. (SS) History, economy, society, politics, and institutions of Canada. C-L: Canadian Studies, Economics 98, History 98, Political Science 98, and Sociology 98. One course. *Cahow or Thompson*

99. Perspectives in Archaeology. (CZ) See C-L: Religion 99; also C-L: Classical Studies 99 and Judaic Studies. One course. *C. Meyers, E. Meyers, Younger, and staff*

101, 102. Introduction to the Civilizations of Southern Asia. (CZ) The literary, historic, linguistic, and ethnic diversity of South Asia presented through both readings and contemporary films. C-L: Asian and African Languages and Literature 160, 161; Comparative Area Studies; Cultural Anthropology 101, 102; History 193, 194; and Religion 160, 161. One course each. *Khanna or staff*

105A. Technology, the Environment, and Modern Culture. A course designed to emphasize the dimension of technology in the FOCUS Program Science, Technology, and Modern Culture and to provide a forum for discussing the relationship among the other courses in the program. Open only to students in that FOCUS Program and required of them. Pass/fail grading only. Half course. *FOCUS Program faculty*

105B. Issues of Contemporary American Culture. Open only to students in the FOCUS Program Twentieth-Century America and required of them. Intended to provide a forum for relating the other courses in the program. Weekly papers and discussion based on a series of programs and readings. Pass/fail grading only. Half course. *FOCUS Program faculty*

105C. Issues in Contemporary Global Culture. Viewed from indigenous and western perspectives. Open only to students in the FOCUS Program Contemporary Global Culture and required of all students in the program. Designed to provide a forum to develop the relationship among the other four courses in the program. Required reading, discussion, and occasional papers. Pass/fail grading only. Half course. *FOCUS Program faculty*

105D. Symposium in Evolution and Humankind. A weekly discussion meeting intended to encourage participants in the FOCUS Program Evolution and Humankind to discuss interdisciplinary and synthetic topics emerging from their experiences in the program's constituent seminars. Open only to participants in the FOCUS program. Pass/fail grading only. Half course. *FOCUS Program faculty*

106. Introduction to the Study of Literature and Society. (AL) See C-L: Literature 101; also C-L: Comparative Area Studies. One course. *F. Lentricchia and Willis*

107S, 108S. Science, Technology, and Human Values. (SS) Open to juniors and seniors in the Science, Technology, and Human Values Program and to other seniors if

space is available. Consent of instructor required. Credit by arrangement: the pair, or either 107S or 108S, may be taken for one course credit. Two half courses or one course. Variable credit. *Strobel and staff*

111. Introduction to Linguistics. (SS) See C-L: Cultural Anthropology 107; also C-L: English 111 and Linguistics. One course. *Butters or Tetel*

112S, 113S. Topics in Science, Technology, and Human Values. Six four-week segments offered sequentially over the fall and spring semesters by faculty of the Program in Science, Technology, and Human Values. Credit for 112S or 113S is awarded for completion of three to five segments within a single academic year; credit for 112S and 113S for completion of six segments. Students who expect to take three to five segments only are encouraged to register for 112S. One course each. *Strobel and staff*

118. Austrian Culture and Politics: Introduction to the Culture and Political Systems of Austria. (CZ) Offered as a part of the Duke in Vienna Program. One course. *Staff*

119. Current Topics in Linguistics. (SS) See C-L: Cultural Anthropology 112; also C-L: English 119 and Linguistics. One course. *Staff*

120. Perspectives on Food and Hunger. (SS) Issues of food and hunger from an interdisciplinary perspective. Lectures present analytic approaches from the natural sciences, social sciences, and the humanities. Pass/fail grading only. C-L: Comparative Area Studies. Half course. *Johns*

120A. Perspectives on Food and Hunger. (SS) See Interdisciplinary Course 120. Lectures, weekly discussion meetings, and individual research. C-L: Comparative Area Studies and Political Science 176A. One course. *Johns*

120B. Perspectives on Food and Hunger. (SS) See Interdisciplinary Course 120. Lectures, community internship project, and discussion meetings. C-L: Comparative Area Studies and Political Science 176B. One course. *Johns*

124. Human Development. (SS) Biological, behavioral, and cultural perspectives and approaches. Multidisciplinary. Especially for sophomores. Juniors and seniors by consent only. C-L: Human Development, Psychology 124, and Sociology 124. One course. *N. Anderson and staff*

139. Marxism and Society. (SS) See C-L: Cultural Anthropology 139; also C-L: Comparative Area Studies, Education 139, History 186, and Sociology 139. One course. *Wilson*

162, 163. Introduction to Islamic Civilization. (CZ) Extensive survey of Muslim peoples and institutions. 162: The Middle Eastern origins and cultural attainments of medieval Islam. 163: Modern developments and global features of the Islamic world. C-L: Comparative Area Studies; Cultural Anthropology 147, 148; History 101G, 102G; Medieval and Renaissance Studies; and Religion 162, 163. One course each. *Cornell, Lawrence, and staff*

164. History and Religions of North Africa. (CZ) See C-L: Religion 164; also C-L: African and Afro-American Studies 164, Comparative Area Studies, and History 187. One course. *Cornell or Lawrence*

180. Psychosocial Aspects of Human Development. (SS) See C-L: Psychology 130; also C-L: Human Development and Sociology 169. One course. *Martin Lakin and Maddox*

182. Media in Comparative Perspective. (SS) Impact of mass media outside the United States. Cross-national comparisons of media content, audiences, and control.

Relationships of governments to media and media policies. International flow of media materials and their cross-national impact. C-L: Canadian Studies, Comparative Area Studies, Film and Video, Political Science 180, and Sociology 182. One course. *Paletz or Smith*

184S. Canadian Issues. (SS) Persistent and current issues facing the Canadian nation-state, among them: cultural and regional political divisions, Indian-Eurocanadian relations, the development of the Canadian welfare state, Canada's place in the international community and in the world economy. Prerequisite: Interdisciplinary Course 98 or consent of instructor. C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 184S, Economics 184S, History 184S, Political Science 184S, and Sociology 184S. One course. *Cahow or Thompson*

186S. Research Internship in Primatology. (NS) Part of the Undergraduate Program in Primatology. Supervised work either in a laboratory or at the Primate Center. Consent of instructor required. C-L: Biological Anthropology and Anatomy 186S. One course. *Glander or White*

187S. Senior Seminar in Primatology. (NS) Part of the Undergraduate Program in Primatology. Consent of instructor required. C-L: Biological Anthropology and Anatomy 187S. One course. *Glander or White*

188S. The Diaghilev Ballet, 1909-1929. (AL) Prerequisite: junior or senior standing or consent of instructor. See C-L: Dance 188S; also C-L: Institute of the Arts 121S. One course. *Dickinson and staff*

190. Research Apprenticeship in Human Development. Part of the Undergraduate Program in Human Development. Supervised work may be in a laboratory, project, or organizational setting. Consent of instructor required. C-L: Human Development. One course. *Maddox and staff*

191S. Senior Seminar in Human Development. (SS) Part of the Undergraduate Program in Human Development. Consent of instructor required. C-L: Human Development. One course. *Thompson and staff*

192S. Special Topics in Human Development. (SS) Part of the Human Development Program. Selected theoretical and methodological topics with emphasis on social change and public leadership in aging societies. C-L: Human Development. One course. *Maddox and staff*

198S. Current Topics on Latin America. Interdisciplinary study of geographical, historical, economic, governmental, political, and cultural aspects of modern Latin America and the current issues facing the region. For juniors and seniors. C-L: Comparative Area Studies. One course. *Staff*

199S. Senior Seminar in German Studies. (CZ) Review of current debates and historical perspectives in the German cultural field, structured through contributing disciplines: social and economic history, political theory and history, literature, fine arts, music, philosophy, and religion. Team-taught, involving a wide range of faculty in the German Studies Program. C-L: German 199S. One course. *Rolleston and staff*

205S. Gender and War. (CZ) An interdisciplinary examination of the relationship between war and gender. Perspectives from literature, history, art, anthropology, zoology, and political science. C-L: Asian and African Languages and Literature 205S and History 205S. One course. *Cooke and Roland*

234S. Political Economy of Development: Theories of Change in the Third World. (SS) See C-L: Political Science 234S; also C-L: Comparative Area Studies, Cultural Anthropology 234S, History 234S, and Sociology 234S. One course. *Staff*

282S. Canada. (SS) See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Economics 282S, Political Science 282S, and Sociology 282S. One course. *Cahow or Thompson*

COURSES CURRENTLY UNSCHEDULED

155. Comparative Perspectives on Literature and Social Change: From Plantation to City. (AL)

Interdisciplinary German Studies Program

Professor Rolleston, *Director*

A certificate, but not a major, is available in this program.

The program provides the opportunity for an interdisciplinary and in-depth study of the culture and civilization of the German-speaking peoples past and present.

Departments cooperating with the program include Art and Art History, Germanic Languages and Literature, History, Music, Philosophy, Political Science, Religion, and Sociology.

Students in the program will earn an Interdisciplinary German Studies Certificate after taking two years of German language study (or the equivalent) in the Department of Germanic Languages and Literature; an interdisciplinary capstone course; and four additional courses drawn from a large list of Interdisciplinary German Studies courses which must fall within thematic clusters. With the help of the Director of the Interdisciplinary German Studies Program, it is possible for a student to design a curriculum that accommodates unusual interests.

Students may also elect this interest in Germany while participating in a Duke-approved study abroad program either during a summer or during their junior year.

Duke offers its own summer program at the Friedrich-Alexander University in Erlangen/Nürnberg and spring and fall semester programs at the Berlin universities. For further information consult the Director of the program, 104 Foreign Languages Building.

Italian

For courses in Italian, see Romance Studies.

Japanese

For courses in Japanese, see Asian and African Languages and Literature.

Judaic Studies Program (Center for Judaic Studies)

Associate Professor Bland (religion), *Director and Director of Undergraduate Studies*; Professors Alt (Germanic languages and literature), C. Meyers (religion), E. Meyers (religion), and Wintermute (religion); Associate Professor Bailey (Divinity School)

A program in Judaic studies may be taken as part of a major in religion or as a supplement to any other major. It may also be taken under Program II. Students are eligible for a certificate in Judaic studies after completing four courses in the program.

For descriptions of the courses consult the listings under the specified departments.

German (Yiddish)

1, 2. Elementary Yiddish. *Staff*

Hebrew

1, 2. Elementary Modern Hebrew. *Staff*

63, 64. Intermediate Modern Hebrew. *Staff*

125, 126. Advanced Modern Hebrew. *Staff*

181S. Hebrew Literature in Translation: The Golden Age. *Staff*

191, 192, 193, 194. Independent Study. *Staff*

Interdisciplinary Course

99. Perspectives in Archaeology. *C. Meyers, E. Meyers, Younger, and staff*

Literature

131. Special Topics in Literature and the Judaic Tradition. *Zucker or staff*

Religion

50. The Old Testament. *C. Meyers, E. Meyers, Peters, or Wintermute*

51. Introduction to Judaic Civilization. *Bland or E. Meyers*

101. Selected Studies in the Bible: Prophets. *Staff*

102. Selected Studies in the Bible: Writings. *Staff*

105. Theology of the Old Testament. *Wintermute*

109. Women in the Biblical Tradition: Image and Role. *C. Meyers*

110. Archaeology and Art of the Biblical World. *C. Meyers or E. Meyers*

115-116. Introduction to Biblical Hebrew. *Bailey*

131D. Principles of Archaeological Investigation. *C. Meyers or E. Meyers*

132D. Palestine in Late Antiquity. *E. Meyers*

133. Foundations of Post-Biblical Judaism. *E. Meyers*

134. Jewish Mysticism. *Bland*

135. Jewish Religious Thought. *Bland*

136. Contemporary Jewish Thought. *Bland or E. Meyers*

195B, 196B. Junior-Senior Seminars: Jewish and Christian Traditions. *Staff*

207, 208. Intermediate Biblical Hebrew. *Staff*

220. Rabbinic Hebrew. *E. Meyers or staff*

221. Readings in Hebrew Biblical Commentaries. *Bland*

243. Archaeology of Palestine in Biblical Times. *C. Meyers*

244. Archaeology of Palestine in Hellenistic-Roman Times. *E. Meyers*

Opportunities for independent study are also offered in the Department of Religion under 191, 192, 193, 194. Procedures for registration and applications are available in 118 Gray Building.

Special attention is directed to those courses in New Testament which are relevant to the study of Rabbinic Judaism—Religion 106, 107, 108, and 111. A list of appropriate courses at the University of North Carolina at Chapel Hill is available in 230C Gray Building, Duke University, and in 101 Saunders Hall, University of North Carolina, Chapel Hill and may be taken under the rubric of the Cooperative Program in Judaic Studies.

Korean

For courses in Korean, see Asian and African Languages and Literature.

Latin

For courses in Latin, see Classical Studies.

Linguistics Courses

Students interested in the study of language as part of their undergraduate program or as preparation for graduate work in linguistics should consult the instructors of the courses listed below or Associate Professor Pugh, Co-Chair, Committee on Linguistics, 316 Languages Building. Students may concentrate in linguistics through Program II. For descriptions of the following courses see the listings of the specified departments.

Asian and African Languages and Literature

131. Introduction to Asian and African Linguistics. *Zhang*

Balto-Finnic

200. Balto-Finnic Linguistics. *Pugh*

Chinese

146. Fundamentals of the Structure of Chinese. *Zhang*

Cultural Anthropology

- 107. Introduction to Linguistics. *Butters or Tetel*
- 112. Current Topics in Linguistics. *Staff*
- 118S. The Language of Advertising. *O'Barr*
- 119. Language, Culture, and Society. *Apte, O'Barr, or Strauss*
- 211S. Ethnography of Communication. *Apte or O'Barr*
- 219. Language and Social Theory. *Apte, O'Barr, or Strauss*
- 250S. Culture and Discourse. *Apte, Ewing, O'Barr, Quinn, or Strauss*

English

- 111. Introduction to Linguistics. *Butters or Tetel*
- 112. English Historical Linguistics. *Butters or Tetel*
- 113A. Introduction to Old English. *Staff*
- 115. Present-Day English. *Butters*
- 118S. The Teaching of Composition, Grammar, and Literature in the Secondary School. *Staff*
- 119. Current Topics in Linguistics. *Staff*
- 205. Semiotics and Linguistics. *Andrews*
- 207A. Introduction to Old English. *Staff*
- 208. History of the English Language. *Butters or Tetel*
- 209. Present-Day English. *Butters*

French

- 131S. French in the New World. *Thomas*
- 210. The Structure of French. *Thomas*
- 211. History of the French Language. *Thomas*

German

- 260. History of the German Language. *Rasmussen*
- 262. Applied Linguistics. *Staff*

Interdisciplinary Courses

- 111. Introduction to Linguistics. *Butters or Tetel*
- 119. Current Topics in Linguistics. *Staff*

Japanese

- 175. Structure of Japanese. *Nagai*

Philosophy

- 103. Symbolic Logic. *Brandon or Posy*
- 109. Philosophy of Language. *Posy*
- 228S. Recent and Contemporary Philosophy. *Posy*
- 250S. Topics in Formal Philosophy. *Posy*

Psychology

- 134. Psychology of Language. *Day*
- 138. Language Development. *Mazuka*
- 153S. Issues in Language Development. *Mazuka*
- 220S. Psycholinguistics. *Day*

Russian

- 119. Topics in Slavic and Northern European Languages. *Staff*
- 150. The Languages of the Soviet Union. *Pugh*
- 185S. Introduction to Slavic Linguistics. *Andrews*
- 186S. History of the Russian Language. *Pugh*
- 201S. A-D. Topics in Comparative Slavic Linguistics. *Andrews or Pugh*
- 203S. Old Church Slavonic. *Pugh*
- 205. Semiotics and Linguistics. *Andrews*
- 207S. Semantics. *Andrews*
- 208. Scientific Russian. *Maksimova*

Spanish

- 119S. Structure of Spanish. *Staff*
- 210. History of the Spanish Language. *Garci-Gómez*

Literature Program (LIT)

Professor Jameson, *Chair*; Associate Professor Gaines, *Director of Undergraduate Studies*; Professors DeNeef, Fish, Moi, V. Mudimbe, A. Patterson, Pérez Firmat, Radway, Rolleston, Schor, B. H. Smith, Stewart, Thomas, and Tompkins; Associate Professors Burian and Kaplan; Research Professor Dorfman; Lecturer Zucker. Affiliated faculty:

Professors Clum (English), L. Patterson (English), and Torgovnick (English); Associate Professors Cooke (Asian and African languages and literature), Morton (Germanic languages and literature), Surin (religion), Wang (Asian and African languages and literature), and Willis (English); Assistant Professor Moses (English)

A major is available in this program.

20S. Introduction to Literature. (AL) Introduction to the study of literature and other forms of cultural expression, such as film. Different introductory approaches will be used in each section (for example, a systematic account of literary genres, a historical survey of ideas and forms of fiction, concepts of authorship and subjectivity, or of literary meaning and interpretation). More than one national literature or culture represented. One course. *Staff*

25. Third World Novel and Film. (AL) Exemplary novels and films from China, India, the Philippines, the Arabic world, and Latin America dramatizing a range of cultural responses to the social, political, and intellectual problems of postcolonial societies. Topics include the conflict between the old and the new; language revolution; the drama of family and clan; nationalism, nativism, and culturalism; the status of the intellectual; the arrival of consumerism; and the status of women. Open only to students in the FOCUS Program Contemporary Global Culture. One course. *Jameson*

25A. Third World Novel and Film. (AL) Same as Literature 25 but open to students not in FOCUS Program. One course. *Staff*

27S. Reading for Yourself. Literature as a point of departure for asking questions about how people learn. The literary texts used as means of exploration of the self, of the environment, and of our relationship to one another. Pass/fail grading only. One course. *Tompkins*

30. Special Topics in National Cinema. (AL) Understanding nationhood through film culture. Industrial base, reception history, and critical context for development of national cinemas. Exemplary films from a range of periods. C-L: Comparative Area Studies and Film and Video. One course. *Staff*

31. Special Topics in Hispanic Cinema. (AL) Focus on images of resistance in cinema from Spain and Latin America. Bunuel, followed by Spanish film under Franco compared with "Third Cinema" in Latin America. Course conducted in English. Knowledge of Spanish helpful but not required. C-L: Film and Video. One course. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

50. What Is Literature? (AL) Introduction to the idea of literature from an innovative and questioning position, to a number of major modern thinkers, and to theory in general. The relationship of literature to history; theories of reading and interpretation; and the concepts and structures of thought associated with modernism and postmodernism. One course. *Staff*

60. Contemporary Literary and Cultural Theory: An Introduction. (AL) The major concepts and principles of contemporary literary theory. "Poststructural" approaches to language and textuality, the invention of "postmodernism," and theories of history and literature. Vocabulary and tools necessary for reading and understanding contemporary critical and theoretical texts. One course. *Staff*

100. Introduction to Comparative Literature. (AL) Basic structures of literature understood as fiction-making: the journey, the hero, the storyteller, the goal of community. Texts from the *Odyssey* to contemporary works, with an introduction to theoretical issues. One course. *Rolleston*

101. Introduction to the Study of Literature and Society. (AL) Literature in relation to history, social situation, and culture. Development of modes of interpretation that juxtapose textual features and broader contextual concern. Readings from Western and non-Western sources representative of a number of periods and genres. C-L: Comparative Area Studies and Interdisciplinary Course 106. One course. *F. Lentricchia and Willis*

102. Introduction to Cultural Studies. (AL) See C-L: English 101B; also C-L: Film and Video. One course. *Gaines, Radway, Surin (religion), Tompkins, or Willis*

103. Great Books in the Western Tradition. (AL) A group of texts central to Western cultural identity from antiquity to the modern age, examined from a variety of critical and theoretical perspectives. Texts and topics vary according to the specializations of participating faculty, but in every case attention given to such fundamental issues as the representation of "human nature;" the relations of individual and society, human and divine, male and female; the transmission and interrogation of ideas and values in literature; and the function of narrative itself in Western culture. One course. *Burian, Janan, and Morton*

121. Introduction to Asian and African Literature. (AL) See C-L: Asian and African Languages and Literature 121. One course. *Staff*

122. The American Imagination. (AL) A syncretic approach to the literature of the Americas, North and South, drawing attention to the underlying homogeneity of New World culture. Borges, Faulkner, Garcia Marquez, Melville, Neruda, Thoreau, and others. One course. *Pérez Firmat*

125. Art and Philosophy from West Africa to the Black Americas. (AL) See C-L: Art 174; also C-L: African and Afro-American Studies 154 and Comparative Area Studies. One course. *Powell*

126. Art and Material Culture of the Southern United States. (AL) See C-L: Art 175. One course. *Powell*

127. The Blues Aesthetic: Afro-American Art in the Twentieth Century. (AL) See C-L: Art 176; also C-L: African and Afro-American Studies 156. One course. *Powell*

129. Latin-American Literature in Translation. (AL) See C-L: Spanish 121; also C-L: Comparative Area Studies. One course. *Dorfman*

131. Special Topics in Literature and the Judaic Tradition. (AL) Selected topics or areas of the writings of the Judaic tradition such as ancient or modern Hebrew literature, Yiddish literature, Jewish mystical philosophy or the literature of the Holocaust. C-L: Judaic Studies and Yiddish 170. One course. *Zucker or staff*

132. Dada and Surrealism. (AL) The international dada and surrealist movement in its multiple manifestations: theater, painting, novel, film, autobiography, and manifesto. Knowledge of French or German desirable. C-L: Comparative Area Studies. One course. *Thomas*

133. Love, Marriage, and Adultery in the Nineteenth-Century European Novel. (AL) Focus on the tradition of the adulterous woman; her transgression of the social norms as a condensed passionate representation of the social, moral, and sexual conflicts of the time. Attention to questions of realism, genre, and plot structure. One course. *Moi*

134. Women in Jewish Literature. (AL) The development of images of Jewish women from biblical times to the present, in works for and about women, written by both male and female authors. Focus on literary craftsmanship as well as religious, historical, and political context. Texts include biblical works, Talmudic material, and

selections from Yiddish, Hebrew, and Anglo-Jewish writers. C-L: Judaic Studies and Women's Studies. One course. *Zucker*

135. National Identity. (AL) A study of literature that aims to define national experience. Topics might include the study of events (such as revolution, civil war) that foster national identity or put it into question, the notion of "imagined communities" and competing cultures, issues of national memory and amnesia and the intersection of gender with national identity. May be taught by a single faculty member or in teams. C-L: Comparative Area Studies. One course. *Farrell, Hell, Kaplan, and Stewart*

136. Autobiography Across Cultures. (AL) A comparative approach to autobiography (including European language memoir, United States slave narrative, Latin American *testimonio*). How do people from different cultures and political situations tell the story of themselves? How does the relationship of individual to community vary according to these traditions and situations? Do men and women "construct a self" differently? C-L: Comparative Area Studies and Women's Studies. One course. *Kaplan and Willis*

142S. Women in Arab Literature. (AL) See C-L: Asian and African Languages and Literature 173S; also C-L: Women's Studies. One course. *Cooke*

143. Canon and Corpus: Literary Studies in Colonial Situations. (AL) The function of literary studies in the context of the humanities and in a world of rapid changes and increasing internationalization. One course. *Mignolo or Willis*

144. Special Topics in Third World or Postcolonial Literature. (AL) Colonial and postcolonial literatures of India, New Zealand and Australia, Canada, Francophone and Anglophone Africa, the Caribbean, North and South America. Organized according to trends, topics, and genres. One course. *A. Davidson, Ferraro, Moses, or Willis*

146. The Canadian Image: Cultural Production in French and English Canada. (AL) What image do Canadians generate of themselves and the world and why? Popular and experimental work in English and French Canadian arts—primarily film and literature, but some painting and music—studied for their meaning in the making or unmaking of a social and political identity and a national image, from the 1960s to the present. C-L: Canadian Studies, Comparative Area Studies, and Film and Video. One course. *A. Davidson*

148S. Literature and Revolution: From the May Fourth to the Post-Mao Era. (AL) See C-L: Chinese 148S; also C-L: Comparative Area Studies. One course. *Wang*

149. Feminism in Twentieth-Century Art. (AL) See C-L: Art 186; also C-L: Women's Studies. One course. *Stiles*

150. Special Topics in Philosophy and Literature. (AL) The great philosophical texts or movements as expressive and linguistic phenomena; either with individual major figures such as Freud, Marx, Nietzsche or Hobbes, or with key theoretical and philosophical movements which have generated a body of texts significant for their literary as well as their philosophical value. One course. *Jameson, Moi, or staff*

151. Special Topics in Women Writers of the World. (AL) Issues of gender and representation in works by women from the Middle Ages to the modern period. Concentration on specific periods, areas, or themes: Relationship of women's literature to the other arts, political practices, and social developments. C-L: Comparative Area Studies and Women's Studies. One course. *Staff*

152. Special Topics in Regional Literatures of the Western World. (AL) Period documents—letters, memoirs, medical treatises, diaries, police records, court decisions, maps (studied together with poetry, short stories, plays)—meant to recreate a picture of

life in a city and a region in particular moments in history. C-L: Comparative Area Studies. One course. *Staff*

156. History of Mass Culture in the United States. (AL) See C-L: English 156. One course. *Gaines, Radway, Tompkins, or Willis*

163. Twentieth-Century American Art. (AL) See C-L: Art 163. One course. *Powell or Stiles*

167. Twentieth-Century Art, 1900-1945. (AL) See C-L: Art 167; also C-L: Comparative Area Studies. One course. *Cernuschi or Stiles*

168. Art since 1945. (AL) See C-L: Art 168; also C-L: Comparative Area Studies. One course. *Cernuschi or Stiles*

171. The History of Conceptual Art. (AL) See C-L: Art 177; also C-L: Comparative Area Studies. One course. *Stiles*

173S. Drama and Theater from 1590 to 1700. (AL) See C-L: Drama 151S; also C-L: English 174A,S. One course. *Clum or Randall*

174. World Theater: Realism and Modernisms. (AL) See C-L: Drama 152; also C-L: English 174B. One course. *Clum or Riddell*

175. Modernism and Modernity. (AL) The structure and form of signification; a close reading of basic modernist texts and a survey of theories about the nature and origins of modernity itself. One course. *Staff*

176. The History of Performance Art. (AL) See C-L: Art 179; also C-L: Comparative Area Studies. One course. *Stiles*

177. Film Theory. (AL) Recent critical developments in Marxist aesthetics, structuralism, semiotics of the image, feminist film theory. Both experimental and Hollywood narrative films. C-L: Film and Video and Women's Studies. One course. *Gaines*

178. Soviet Cinema. (AL) See C-L: Russian 130; also C-L: Film and Video. One course. *Gaines, Jameson, and Lahusen*

180. Writings in the Rural Tradition: From the Caribbean to the American South. (AL) Comparative readings of fiction and poetry from the southern United States and the Caribbean, analyzed in relation to the plantation heritage. C-L: African and Afro-American Studies 180, Comparative Area Studies, and English 180. One course. *Willis*

181. Literacies and Literatures in the Americas and the Caribbean. (AL) An exploration of the social process as well as historical and cultural relevance of the uses of literacy in multilingual and pluricultural realities of the Americas and the Caribbean. One course. *Mignolo or Willis*

184. Introduction to Psychoanalytic Criticism. (AL) Emphasis on texts by Freud and Lacan and the textual theories closely associated with their work. Psychoanalytic theories of art and creativity ranging from Ernest Jones and Hanna Segal to Janine Chasseguet-Smirgel, Sarah Kofman, and Julia Kristeva. Various theories of the relationship between the psychological and the social. One course. *Moi*

185. Psychoanalysis, Literature, and Film. (AL) Genres, styles, and schools in film and literature that attract psychoanalytic readings and raise issues of gender and sexuality: the gothic, horror, melodrama, and romance fiction; surrealism and the avant-garde. C-L: English 181, Comparative Area Studies, Film and Video, and Women's Studies. One course. *Gaines*

186. Sexualities in Film and Video. (AL) The variety of ways sexualities are represented in current mainstream and avant-garde film and video art. Topics include voyeuristic, narcissistic, and other perverse pleasures; modes of representing bodies, genders, and desires (especially gay and lesbian ones) in relation to national and subcultural identities. Readings in film theory as well as related literary and critical texts. C-L: Film and Video. One course. *Clum, Gaines, or Moon*

187. Studies in Film History. (AL) See C-L: English 185; also C-L: Drama 136 and Film and Video. One course. *Clum, Gaines, Jameson, or Moses*

188. Twentieth-Century Modernist and Postmodernist Criticism. (AL) See C-L: Art 188. One course. *Cernuschi or Stiles*

189. Modern Architecture. (AL) See C-L: Art 189. One course. *Wharton*

190S. Senior Seminar. (AL) Topics vary each semester offered. One course. *Staff*

191, 192. Independent Study. Consent of instructor required. One course each. *Staff*

198. Censorship, Law, and Literature. (AL) The history and theoretical implications of censorship as a worldwide phenomenon that, from Plato's time to our own, illuminates many other issues: the role of law in mediating culture; the role of literature in testing the frontiers of cultural change; the relationship between political structures and private, sexual morality. Emphasis on censorship law internationally, on its relation to treason, sedition and libel laws, and the concept of heresy. Clarification of First Amendment issues, and interpretation of certain crucial "literary" trials, such as those concerning Flaubert's *Madame Bovary*, Joyce's *Ulysses*, and Lawrence's *Lady Chatterley's Lover*. Broad historical and international focus also maintained. One course. *A. Patterson*

211. Theory and Practice of Literary Translation. (AL) Linguistic foundations and historical role of translation. Practical exercises and translation assignments. Prerequisites: working knowledge of a foreign language and consent of instructor. One course. *Burian*

254. Introduction to Feminism. (AL) Major trends and tendencies of feminist theory and its history. Perspectives are both international as well as Third World and interdisciplinary. Various feminist methodologies as well as crucial polemics. One course. *Moi or Radway*

280. Semiotics for Literature. (AL) See C-L: French 223. One course. *Thomas*

293. Seminars in Literature and History. (AL) Relationship of literary texts to varieties of historical experience such as wars, periods of revolutionary upheaval, periods of intense economic growth, "times of troubles," or stagnation. Literary texts and historical content posed in such formal ways as the theoretical problem of the relationship between literary expression and form and a range of historical forces and phenomena. One course. *Jameson, Kaplan, Orr, or A. Patterson*

COURSES CURRENTLY UNSCHEDULED

128. Writings in the Pan-African Tradition. (AL)

137. The Political Stage. (AL)

145. The Descent of the Epic. (AL)

155. Comparative Perspectives on Literature and Social Change: From Plantation to City. (AL)

159. Tragedy and the Tragic. (AL)

179. Contemporary Science Fiction. (AL)

THE MAJOR

All students must be able to demonstrate reading knowledge of at least one foreign language either through advanced placement or completion of the appropriate course work. In addition, literature students will be asked to fulfill the requirements in one of two tracks. When students declare the literature major, they will be asked to inform the Director of Undergraduate Studies of the track selected and to work out a tentative course of study.

(1) Literature and Cultural Theory

This track has been designed to enable students to concentrate their efforts upon a comparative study of world literatures. It is understood that the Director of Undergraduate Studies will encourage majors in this track to develop a coherent rationale for the kind of comparisons they are undertaking (for example, of specific national literatures, within a particular historical period) and will ensure that students take an appropriate number of more theoretical courses as well. Students will be required to take a total of eight courses distributed in the following manner.

a. *One* course (appropriate to the student's particular interests) which engages the idea of literature from a theoretical, procedural, or comparative perspective. Students should choose from the following list of courses: Literature 50, 100, 101, and 102.

b. *Five* courses in the Program in Literature to be approved by the Director of Undergraduate Studies.

Students who are not completing honors in the program must plan to include at least one seminar course among these five. This requirement will normally be fulfilled by taking Literature 190, the senior seminar. The seminar will be a topical, problem-oriented seminar focused on a broad subject such as society and psychoanalysis. The point of the course will be to raise theoretical questions and to enable the students to think more systematically about the procedures, rationale, and methods of literary study. Non-honors students will be asked to submit a substantial research paper at the end of the course.

Honors students will be asked to include two seminar courses among their five. This requirement will be fulfilled by taking Literature 190, the senior seminar, in the fall of the senior year, and Literature 191, the honors thesis, in spring of the senior year. Students must apply for this honors sequence by February 1 of the junior year. Applicants must have completed at least two Literature Program courses and one course in the literature of a foreign language and have a minimum B+ average in those courses. Applicants should apply to the Director of Undergraduate Studies and must include both a writing sample and a letter from one of their instructors. The Literature Program's honor's committee will evaluate all applications and the final theses themselves. Students not awarded the honors designation will receive graded credit for Literature 190 and Literature 191.

c. *Two* courses in literature taught in a foreign language. The topics, periods, and foci of these courses should intersect in some way with the courses elected from within the Literature Program.

(2) Literature and Media Studies

This track has been designed to meet the needs of the many students who wish to elect a literature major but who want to concentrate more specifically upon the contemporary media and their attendant technologies. Students will be asked to develop a rationale for their course selection and to demonstrate to the Director of Undergraduate Studies that they have addressed both theoretical and substantive questions in the courses they have taken. Students will be required to take a total of eight courses distributed in the following manner:

a. Literature 102, Introduction to Cultural Studies.

b. *Three* courses in the Program in Literature. Non-honors students must include one seminar course among these three. This requirement will normally be fulfilled by Literature 190, the senior seminar. Honors students must include two seminar courses

among these three. This requirement will be fulfilled by Literature 190 and Literature 191. For honors procedures, see listing under Track (1).

c. Two courses in literature from the following list: Literature 156, 177, 179, 185, and 187.

d. One course from outside the Literature Program in the area of media studies (for example, English 187, Cultural Anthropology 110, Public Policy Studies 163S, Public Policy Studies 177S, Public Policy Studies 180S). This course must be approved by the Director of Undergraduate Studies.

e. One literature course in a foreign language at the 100 level or above.

Management Sciences Courses (MS)

The courses listed below are elective courses, which do not count for area of knowledge requirements in Trinity College. A major is not offered in Management Sciences. The courses may be helpful in preparation for graduate education in business and law and may provide liberal arts, science, and engineering students an advancement in placement.

53. Introductory Financial Accounting. The accounting model of the firm and transactions analysis. Topics include the procedures used to process accounting data, issues in asset valuation and income determination, and financial statement analyses. Prerequisite: sophomore standing. One course. *Staff*

120. Managerial Effectiveness. Understanding the nature of management and the factors that influence the effective performance of managers. Topics include the nature of managerial effectiveness; managing groups; leadership strategies; performance motivation and appraisal; conflict management; the manager as decision maker and negotiator. Prerequisite: junior standing. One course. *Staff*

137. Managerial Accounting. The use of accounting information by management in short-term planning, control, and decision making in business enterprises. Cost accumulation, cost analysis, cost estimation, the development of standards, introduction to budgeting, and short-run decisions. Prerequisite: Management Sciences 53 or consent of instructor. One course. *Staff*

161. Marketing Management. The role of the marketing function in business; product planning, price, promotion, and distribution as elements of a total marketing mix. Formal models in solving the marketing mix problem of the firm. Prerequisite: junior standing. One course. *Staff*

193, 194. Independent Study. Directed reading and research. Open only to qualified juniors and seniors with consent of instructor and Director of Undergraduate Studies. Variable credit. *Staff*

COURSES CURRENTLY UNSCHEDULED

171. Production and Operations Management

Marine Biology

For courses in marine biology, see Biology, Environment (School), and the University Program in Marine Sciences.

The University Program in Marine Sciences

Professor Ramus (botany and environment), *Director*; Professor Forward (zoology and environment), *Assistant Director and Director of Undergraduate Student Affairs*; Professors Barber (botany, environment, geology, and zoology), C. Bonaventura (cell biology and

environment), J. Bonaventura (cell biology and environment), Gutknecht (cell biology and environment), Johnson (geology and environment), Pilkey* (geology), Searlest (botany), and Sutherland (zoology and environment); Associate Professor Rittschof (zoology and environment); Assistant Professors Gerhart (environment), Howd (environment), and Lozier (environment); Professor Emeritus Bookhout (zoology); Professor of the Practice Kirby-Smith (environment); Research Associate Professor Brouwer (environment); Research Assistant Professors Clare (environment), Scholz (environment), and Van Beneden (environment); Research Assistant Professors Scholz (environment) and Van Beneden (environment, and Assistant Medical Research Professor of cell biology)

The interdisciplinary program in marine sciences provides students with a unique opportunity to live and study at the Duke University Marine Laboratory for a full academic semester—fall or spring or during the summer terms. The program emphasizes small class size, independent study, and integrated classroom, laboratory, and field experience. Students have daily access to modern scientific equipment, a specialized library, and the surrounding natural marine environment.

The fall and spring semesters are offered primarily for juniors and seniors. Participation in either the fall or spring semester is possible for all majors with appropriate preparation. Before attending a semester program, it is advised that students have completed introductory college courses in biology, chemistry, mathematics, and physics. Students wishing to apply to the fall or the spring semester must submit an application form which contains the written approval of their faculty advisor to the Admissions Office, Duke University, School of the Environment, Marine Laboratory, Beaufort, North Carolina 28516, prior to Duke's registration period for the desired semester. Students will be notified of the action of the Admissions Committee shortly after receipt of their application. Applications received after Duke's registration period for the desired semester will be considered if space is available.

The summer curriculum, taught in three five-week terms, includes a rich assortment of courses in the natural sciences. Attention is also directed to the introductory course in marine biology (Biology 10L), designed specifically for students not majoring in a natural science.

Applications for summer courses must contain the written approval of the student's advisor or dean, must be accompanied by a current academic transcript (transcript not required of students applying to Biology 10L) and should be submitted by the end of March or earlier to the address indicated above. Thereafter, applications will be considered if space is available.

A number of summer tuition scholarships are available on a competitive basis. Please consult the *Marine Laboratory 1993* publication for specific requirements and deadline dates, or contact the Admissions Office of the Marine Laboratory.

The courses below are described in the bulletin listings of the specified departments. See also the *Marine Laboratory 1993* publication and the *Duke University Official Schedule of Courses* for the current schedule of courses. For information on courses fulfilling requirements of the biology, environmental studies and policy, or geology major consult the Director of Undergraduate Studies for the major.

FALL, SPRING, OR SUMMER COURSES AT BEAUFORT

Marine Biology. (Biology 10L.) For students not majoring in a natural science. One course. *Staff*

*Spring only.

†Summer only.

Climatic Change. (Geology 109 or Geology 209.) For Geology 209, additional requirement of term paper. One course. *Johnson*

Behavioral Ecology. (Biology 113L.) Prerequisite: Biology 21L, 22L. One course. *Rubenstein (visiting summer faculty)*

Biological Oceanography. (Biology 114L or Environment 292L.) Prerequisite: Biology 21L, 22L. One course (spring); one and one-half courses (summer). *Barber or Ramus*

Biology of Marine Macrophytes. (Biology 117L.) Prerequisites: Biology 21L, 22L; and Chemistry 11L, 12L or equivalent. One course. *Ramus*

Analysis of Ocean Ecosystems. (Biology 123 or Environment 293.) Prerequisite: one year of biology and chemistry, or consent of instructor. One course. *Barber*

Physiology of Marine Animals. (Biology 150L.) Prerequisites: Biology 21L, 22L; and chemistry. One course. *Forward*

Biochemistry of Marine Animals. (Biology 155L.) Prerequisites: Biology 21L, 22L; and Chemistry 11L, 12L. One Course. *Rittschof*

Marine Communities. (Biology 169L or Environment 294L.) Prerequisites: Biology 21L, 22L; and Mathematics 31. One course. *Gerhart*

Marine Invertebrate Zoology. (Biology 176L or Environment 295L.) Not open to students who have taken Zoology 274L. Prerequisite: Biology 21L, 22L. One course (fall); one and one-half courses (summer). *Kirby-Smith*

Independent Study. (Biology 191, 192; Environment 191, 192; Geology 191, 192, 195; or as listed under the student's major department.) For junior and senior majors with consent of appropriate Director of Undergraduate Studies and supervising instructor. Credit to be arranged. *Staff*

Light in the Sea. (Biology 195S or Biology 196S.) Half course. *Ramus*

Human Impact on the Natural Environment. (Biology 195S or Biology 196S.) Half course. *Barber*

Dolphin and Whale Biology. (Biology 196S.) Half course. *Forward and staff*

Marine Policy. (Environment 276S or Public Policy Studies 195S.) One course. *Orbach (visiting summer faculty)*

Beach and Island Geological Processes. (Geology 196S.) Half course. *Pilkey*

Marine Ecology. (Biology 203L or Environment 219L.) Prerequisite: none; suggested—introductory ecology, invertebrate zoology, or marine botany. One and one-half courses. *Gerhart*

Physical Oceanography. (Environment 290 or Geology 203.) Prerequisite: Mathematics 31 and 32 or consent of instructor. One course. *Lozier*

Barrier Island Ecology. (Biology 218L or Environment 218L.) Prerequisite: introductory biology; suggested: course in botany or ecology. One and one-half courses. *Evans, Peterson, and Walls (visiting summer faculty)*

Benthic Marine Algae. (Biology 219L or Environment 296L.) Prerequisite: Biology 21L, 22L; plant diversity recommended. One course. *Schneider (visiting summer faculty)*

Coastal Processes. (Environment 222S or Geology 201S.) Prerequisites: Mathematics 31 and 32. Half course. *Howd*

Advanced Research Training in Marine Molecular Biology and Biotechnology. (Cell Biology 235 or Cell Biology 235L.) Prerequisite: consent of instructor. One course (Cell Biology 235); one and one-half courses (Cell Biology 235L). *Van Beneden*

Environmental Biochemistry. (Cell Biology 243 or Environment 243.) Prerequisite: organic chemistry. One course. *Bonaventura and Brouwer*

Cellular and Molecular Research Techniques. (Cell Biology 244 or Environment 244.) Prerequisite: organic chemistry. One course. *Bonaventura and Brouwer*

Techniques in Environmental Data Analysis. (Environment 252L or Geology 222.) Prerequisites: Mathematics 31 and 32. One course. *Howd*

Molecular and Cellular Adaptations of Marine Organisms. (Cell Biology 270S.) Half course. *Bonaventura*

Biology of Marine Invertebrates. (Biology 274L or Environment 297L.) Not open to students who have had Biology 176L. Prerequisite: Biology 21L, 22L or equivalents. One and one-half courses. *Dimock (visiting summer faculty)*

Geological Oceanography. (Environment 291S or Geology 205S.) Not open to students who have taken Geology 206S. One course. *Johnson*

Marine Animal Navigation. (Biology 295S or Biology 296S.) Half course. *Forward*

Marine Fishes: Selected Topics. (Biology 295S or Biology 296S.) Half course. *Forward and McCleave*

The Ecology of Chemical Signals. (Biology 295S or 296S.) Half course. *Rittschof*

Natural History of Coastal Marine Systems. (Biology 295S or 296S.). Half course. *Kirby-Smith*

COURSES CURRENTLY UNSCHEDULED

Macromolecules, Ecology, and Evolution. (Biochemistry 245L.)

Marine Biochemistry and Genetics. (Biochemistry 266S.)

Comparative and Evolutionary Biochemistry. (Biochemistry 276L.)

The Ocean's Role in Climate. (Biology 115L.)

Tropical Seaweeds. (Biology 263L.)

Experimental Ecology of the Marine Intertidal Zone. (Biology 296S.)

The Coastal Environment: Science vs. Policy. (Biology 295S.)

Analysis of Coastal Ecosystems. (Biology 296S.)

Markets and Management Studies

Associate Professor Spenner, *Director*

A certificate, but not a major, is available in this program.

The program offers students the opportunity to take a cluster of courses dealing with problems of how organizations are formed and managed, how transactions between people and organizations are structured in markets, how and why patterns of consumption change, what distinguishes good from bad management in both the practical and ethical sense, how approaches to management and marketing have changed over time, and how these approaches vary from one country and one sector of the economy to another. The program should be of particular interest to students interested in pursuing a career in business.

In addition to offering courses and a certificate on completion of the requirements, the Markets and Management Program also sponsors lectures, films, discussions and internships. It offers career counseling for prebusiness students, who are invited to make use of a resource room (Room 331 in the Department of Sociology) for meetings with faculty and other students in the program, and to consult relevant journals and newspapers. Additional information may be obtained from Professors Spenner or Wilson in the Sociology Department.

COURSE OF STUDY

The course of study for program participants is intended to be interdisciplinary. The core of the program consists of sociology courses, with a large number of electives available for selection from eight other departments. The certificate requires six courses, two of which must be drawn from a core set of management and markets studies courses. The third core course is be a capstone course, an advanced sociology seminar in organization theory. The rest of the courses are considered electives, and at least two of these must be taken in departments other than sociology.

PROGRAM COURSES

Core Courses

Sociology 142. Organizations and Global Competitiveness

Sociology 144. Organizations and Environments

Sociology 155. Organizations and Management
 Sociology 158. Markets and Marketing
 Sociology 159. Entrepreneurship
 Sociology 225. Seminar in Organizations, Markets, and Work

Elective Courses

Cultural Anthropology 110. Advertising and Society
 Cultural Anthropology 118. Language of Advertising
 Economics 134. Japanese Economy and History
 Economics 140. Comparative Economic Systems
 Economics 165. American International Economic Policy
 Economics 188. Industrial Organization
 Economics 189. Business and Government
 Education 140. The Psychology of Work
 History 143B. The Emergence of Modern Japan
 Interdisciplinary Course 112S, 113S. Topics in Science, Technology, and Human Values
 Management Science 120. Managerial Effectiveness
 Management Science 161. Marketing Management
 Political Science 121. International Organization
 Political Science 147. International Environment Politics and Policies
 Public Policy Studies 145. Leadership, Policy, and Change
 Public Policy Studies 146. Leadership and Judgment
 Public Policy Studies 195S.61. Corporate Leadership
 Religion 151. Ethical Issues in Social Change and Public Policy
 Religion 174. Technology Assessment and Social Change
 Sociology 112. American Demographics
 Sociology 126. Third World Development
 Sociology 135. Computers and Society
 Sociology 143. Management and Labor Relations
 Sociology 156. Global Contexts of Science and Technology
 Sociology 165. Occupations, Professions, and Careers

Mathematics (MTH)

Professor Schaeffer, *Chair*; Associate Professor Kraines, *Associate Chair*; Associate Professor Scoville, *Director of Undergraduate Studies*; Assistant Professor of the Practice Blake, *Supervisor of Freshman Instruction*; Professors Allard, Beale, Bryant, Hain, Lawler, Morrison, Pardon, Reed, Rose, Stern, Venakides, Warner, and Weisfeld; Associate Professors Burdick, R. Hodel, Kitchen, Moore, Saper, Schoen, Smith, and Trangenstein; Assistant Professors Layton, Yang, and Zheng; Professors Emeriti Carlitz, Dressel, Elliott, Murray, Roberts, and Shoenfield; Assistant Professor of the Practice Bookman; Adjunct Professor Chandra; Visiting Professors Harer and Neu; Visiting Assistant Professor Tau; Lecturer Dempster; Instructors M. Hodel, Lee, Mathews, McCarter, and Morris

A major is available in this department.

19. Precalculus Mathematics. (QR) For students with CB Achievement Test scores between 460 and 540 or SAT scores between 500 and 600. Selected topics in algebra, trigonometry, and analytic geometry; projects and writing assignments. Designed to increase the mathematical skills and knowledge of students planning to enroll in Mathematics 31. One course. *Staff*

31. Introductory Calculus I. (QR) Functions, limits, continuity, trigonometric functions, techniques and applications of differentiation, indefinite and definite integrals, the fundamental theorem. One course. *Staff*

31L. Laboratory Calculus I. (QR) Introductory calculus with a computer laboratory component. Emphasis on projects, group work, and written reports. Differentiation, transcendental functions, differential equations, numerical approximations. One course. *Staff*

32. Introductory Calculus II. (QR) Transcendental functions, techniques and applications of integration, indeterminate forms, improper integrals, infinite series. Not open to students who have had Mathematics 41. Prerequisite: Mathematics 31 or 33. One course. *Staff*

32L. Laboratory Calculus II. (QR) Second semester of introductory calculus with a computer laboratory. Emphasis on projects, group work, and written reports. Integration, the fundamental theorem, methods of integration, improper integrals, polynomial approximation. Not open to students who have had Mathematics 41. Prerequisite: Mathematics 31L or consent of instructor. One course. *Staff*

32X. Introductory Honors Calculus II. (QR) Similar to Mathematics 32, but faster paced and more challenging. Open to students who score at least 750 on the SAT Mathematics Aptitude Test. One course. *Staff*

41. One Variable Calculus. (QR) Meets five times a week, quickly reviews differential calculus and then covers integral calculus and infinite series. Designed for freshmen who have had a year of calculus in high school and have Mathematics SAT scores of 650 or above, but who have not received advanced placement credit for Mathematics 31. Not open to students who have had Mathematics 31 or 32 or 31L or 32L. One and one-half courses. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

103. Intermediate Calculus. (QR) Partial differentiation, multiple integrals, topics in differential and integral vector calculus. Prerequisite: Mathematics 32, 32L, or 41. One course. *Staff*

103L. Laboratory Calculus III. (QR) Intermediate calculus with a computer laboratory. Emphasis on projects, group work, and written reports. Curves in space, partial differentiation, multiple integrals, two-dimensional vector calculus. Prerequisite: Mathematics 32, 32L, or 41, or consent of instructor. One course. *Staff*

103X, 104X. Honors Intermediate Calculus and Linear Algebra. (QR) Similar to Mathematics 103, 104, but more theoretical. Students who have taken 32X are encouraged to enroll. Students continuing from 103X should take 104X rather than 104. One course each. *Staff*

104. Linear Algebra and Applications. (QR) Systems of linear equations and elementary row operations, Euclidean n -space and subspaces, linear transformations and matrix representations, Gram-Schmidt orthogonalization process, determinants, eigenvectors and eigenvalues; applications. Prerequisite: Mathematics 32 or 41. One course. *Staff*

111. Applied Mathematical Analysis I. (QR) First and second order differential equations with applications; matrices, eigenvalues, and eigenvectors; linear systems of differential equations; Fourier series and applications to partial differential equations. Intended primarily for engineering and science students with emphasis on problem solving. Not open to students who have had Mathematics 131. Prerequisite: Mathematics 103. One course. *Staff*

114. Applied Mathematical Analysis II. (QR) Boundary value problems, complex variables, Cauchy's theorem, residues, Fourier transform, applications to partial differential equations. Not open to students who have had Mathematics 181 or 230. Prerequisites: Mathematics 111 or 131, or 103 and consent of instructor. One course. *Staff*

121. Introduction to Abstract Algebra. (QR) Groups, rings, and fields. Students intending to take a year of abstract algebra should take Mathematics 200 and 201. Not

open to students who have had Mathematics 200. Prerequisite: Mathematics 104 or 111. One course. *Staff*

123S. Geometry. (QR) Euclidean geometry, inverse and projective geometries, topology (Möbius strips, Klein bottle, projective space), and non-Euclidean geometries in two and three dimensions; contributions of Euclid, Gauss, Lobachevsky, Bolyai, Riemann, and Hilbert. Prerequisite: Mathematics 32 or 41, or consent of instructor. One course. *Staff*

124. Combinatorics. (QR) Permutations and combinations, generating functions, recurrence relations; topics in enumeration theory, including the Principle of Inclusion-Exclusion and Polya Theory; topics in graph theory, including trees, circuits, and matrix representations; applications. Prerequisite: Mathematics 104 or consent of instructor. One course. *Staff*

126. Introduction to Linear Programming and Game Theory. (QR) Fundamental properties of linear programs; linear inequalities and convex sets; primal simplex method, duality; integer programming; two-person and matrix games. Prerequisite: Mathematics 104. One course. *Staff*

128. Number Theory. (QR) Divisibility properties of integers, prime numbers, congruences, quadratic reciprocity, number-theoretic functions, simple continued fractions, rational approximations; contributions of Fermat, Euler, and Gauss. Prerequisite: Mathematics 32 or 41, or consent of instructor. One course. *Staff*

128S. Number Theory. (QR) Same as Mathematics 128, but offered as a seminar. One course. *Staff*

131. Elementary Differential Equations. (QR) Solution of differential equations of elementary types; formation and integration of equations arising in applications. Not open to students who have had Mathematics 111. Prerequisite: Mathematics 103; corequisite: Mathematics 104. One course. *Staff*

132S. Qualitative Theory of Ordinary Differential Equations. (QR) Qualitative behavior of general systems of ordinary differential equations, with application to biological and ecological systems, oscillations in biochemistry, electrical networks, and the theory of deterministic epidemics. Prerequisite: Mathematics 131 or 111 or consent of instructor. One course. *Staff*

135. Probability. (QR) Probability models, random variables with discrete and continuous distributions. Independence, joint distributions, conditional distributions. Expectations, functions of random variables, central limit theorem. Prerequisite: Mathematics 103. C-L: Statistics 104. One course. *Staff*

135S. Probability. (QR) Seminar version of Mathematics 135. In addition, each student will be required to do a project which illustrates the theory. Prerequisite: Mathematics 103. C-L: Statistics 104S. One course. *Staff*

136. Statistics. (QR) Sampling distributions, point and interval estimation, maximum likelihood estimators. Tests of hypotheses, the Neyman-Pearson theorem. Bayesian methods. Not open to students who have had Statistics 112 or 213. Prerequisites: Mathematics 104 and 135. C-L: Statistics 114. One course. *Staff*

139. Advanced Calculus I. (QR) Algebraic and topological structure of the real number system; rigorous development of one-variable calculus including continuous, differentiable, and Riemann integrable functions and the Fundamental Theorem of Calculus; uniform convergence of a sequence of functions; contributions of Newton, Leibniz, Cauchy, Riemann, and Weierstrass. Not open to students who have had Mathematics 203. Prerequisite: Mathematics 103. One course. *Staff*

149S. Problem Solving Seminar. (QR) Techniques for attacking and solving challenging mathematics problems and writing mathematical proofs. Course may be repeated. Consent of instructor required. Half course. *Staff*

150. Topics in Mathematics from a Historical Perspective. (QR) Content of course determined by instructor. Prerequisite: Mathematics 139 or 203 or consent of instructor. One course. *Staff*

150S. Topics in Mathematics from a Historical Perspective. (QR) Same as Mathematics 150, but offered as a seminar. One course. *Staff*

160. Mathematical Numerical Analysis. (QR) Zeros of functions; polynomial interpolation and splines; numerical integration and differentiation; applications to ordinary differential equations; numerical linear algebra; error analysis; extrapolation and acceleration. Not open to students who have had Computer Science 121 or 221. Satisfies the prerequisite for Computer Science 222 and 223. Prerequisites: Mathematics 103 and 104 and knowledge of an algorithmic programming language, or consent of instructor. One course. *Staff*

160S. Mathematical Numerical Analysis. (QR) Same as Mathematics 160, but offered as a seminar. One course. *Staff*

181. Complex Analysis. (QR) Complex numbers, analytic functions, complex integration, Taylor and Laurent series, theory of residues, argument maximum principles, conformal mapping. Not open to students who have had Mathematics 114 or 231. Prerequisite: Mathematics 139 or 203. One course. *Staff*

187. Introduction to Mathematical Logic. (QR) Propositional calculus; predicate calculus. Gödel completeness theorem, applications of number theory, incompleteness theorem, additional topics in proof theory or computability; contributions of Aristotle, Boole, Frege, Hilbert, and Gödel. Prerequisites: Mathematics 103 and 104 or Philosophy 103. One course. *Staff*

191, 192. Independent Study. Directed reading and research. Admission by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

193, 194. Independent Study. Same as 191, 192, but for seniors. One course each. *Staff*

196S. Seminar in Mathematical Model Building. (QR) Real models, mathematical models, axiom systems as used in model building, deterministic and stochastic models, linear optimization, competition, graphs and networks, growth processes, evaluation of models. Term project: model of a nonmathematical problem. Prerequisites: Mathematics 103 and 104. One course. *Staff*

197S. Seminar in Mathematics. (QR) Intended primarily for juniors and seniors majoring in mathematics. Topics vary. Prerequisites: Mathematics 103 and 104. One course. *Staff*

198S, 199S. Honors Seminar in Mathematics. (QR) Topics vary. Consent of instructor and Director of Undergraduate Studies required. One course each. *Staff*

For Seniors and Graduates

200. Introduction to Algebraic Structures I. (QR) Laws of composition, groups, rings; isomorphism theorems; axiomatic treatment of natural numbers; polynomial rings; division and Euclidean algorithms. Not open to students who have had Mathematics 121. Prerequisite: Mathematics 104 or equivalent. One course. *Staff*

201. Introduction to Algebraic Structures II. (QR) Vector spaces, matrices and linear transformations, fields, extensions of fields, construction of real numbers. Prerequisites: Mathematics 200, or Mathematics 121 and consent of instructor. One course. *Staff*

203. Basic Analysis I. (QR) Topology of R^n , continuous functions, uniform convergence, compactness, infinite series, theory of differentiation, and integration. Not open to students who have had Mathematics 139. Prerequisite: Mathematics 104. One course. *Staff*

204. Basic Analysis II. (QR) Inverse and implicit function theorems, differential forms, integrals on surfaces, Stokes' theorem. Not open to students who have had Mathematics 140. Prerequisites: Mathematics 203, or Mathematics 139 and consent of instructor. One course. *Staff*

205. Topology. (QR) Elementary topology, surfaces, covering spaces, Euler characteristic, fundamental group, homology theory, exact sequences. Prerequisite: Mathematics 104. One course. *Staff*

206. Differential Geometry. (QR) Geometry of curves and surfaces, the Serret-Frenet frame of a space curve, the Gauss curvature, Cadazzi-Mainardi equations, the Gauss-Bonnet formula. Prerequisite: Mathematics 104. One course. *Staff*

221. Numerical Analysis. (QR) Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. See C-L: Computer Science 221; also C-L: Statistics 273. One course. *Gardner or Greenside*

222. Numerical Differential Equations. (QR) Prerequisite: Computer Science 221. See C-L: Computer Science 222. One course. *Gardner, Greenside, or Rose*

223. Numerical Linear Algebra. (QR) See C-L: Computer Science 223. One course. *Gardner, Greenside, or Rose*

230. Mathematical Methods in Physics and Engineering I. (QR) Heat and wave equations, initial and boundary value problems, Fourier series, Fourier transforms, potential theory. Not open to students who have had Mathematics 114. Prerequisites: Mathematics 103 and 104 or equivalents. One course. *Staff*

231. Mathematical Methods in Physics and Engineering II. (QR) Green's functions, partial differential equations in several space dimensions. Complex variables, analytic functions, Cauchy's theorem, residues, contour integrals. Other topics may include method of characteristics, perturbation theory, calculus of variations, or stability of equilibria. Prerequisite: Mathematics 114 or 230. One course. *Staff*

233. Asymptotic and Perturbation Methods. (QR) Asymptotic solution of linear and nonlinear ordinary and partial differential equations. Asymptotic evaluation of integrals. Singular perturbation. Boundary layer theory. Multiple scale analysis. Prerequisite: Mathematics 114 or equivalent. One course. *Staff*

238. Topics in Applied Mathematics. (QR) Conceptual basis of applied mathematics, combinatorics, graph theory, game theory, mathematical programming, or numerical solution of ordinary and partial differential equations. Prerequisites: Mathematics 103 and 104 or equivalents. One course. *Staff*

240. Applied Stochastic Processes. (QR) Applications of probability theory and stochastic processes to economics and environmental science. Markoff chains, optional stopping, queuing theory, decision theory, birth and death processes, and the Monte Carlo method. Prerequisite: Mathematics 135 or equivalent. C-L: Statistics 253. One course. *Staff*

241. Linear Models. (QR) Prerequisites: Mathematics 104 and Statistics 113 or 210. See C-L: Statistics 244. One course. *Staff*

242. Introduction to Multivariate Statistics. (QR) Prerequisite: Statistics 244 or equivalent. See C-L: Statistics 245. One course. *Burdick*

245. Functional Analysis for Scientific Computing. (QR) See C-L: Computer Science 245. One course. *Rose*

251. Set Theory I. (QR) Zermelo-Fraenkel axioms, ordinals and cardinals, models of set theory, constructible sets. Prerequisite: Mathematics 187 or 200 or equivalent. One course. *Staff*

252. Set Theory II. (QR) Forcing, large cardinals, determinateness, and other advanced topics. Prerequisite: Mathematics 251. One course. *Staff*

253. Recursion Theory. Register and Turing machines; recursive functions and sets; enumeration theorems; recursively enumerable sets; arithmetical and analytic hierarchies; degrees; unsolvable problems; complexity theory. Prerequisite: Mathematics 187 or Mathematics 200 or equivalent. One course. *Staff*

258, 259. Topics in Logic. (QR) Model theory, recursion theory, set theory, or other fields of logic. Prerequisite: Mathematics 250 or equivalent. One course each. *Staff*

260. Groups, Rings, and Fields. (QR) Groups including nilpotent and solvable groups, p-groups and Sylow theorems; rings and modules including classification of modules over a PID and applications to linear algebra; fields including extensions and Galois theory. Prerequisite: Mathematics 201 or equivalent. One course. *Staff*

261. Commutative Algebra. (QR) Extension and contraction of ideals, modules of fractions, primary decomposition, integral dependence, chain conditions, affine algebraic varieties, Dedekind domains, completions. Prerequisite: Mathematics 260 or equivalent. One course. *Staff*

268. Topics in Algebra. (QR) Algebraic number theory, algebraic K-theory, homological algebra, or topological algebra. Prerequisite: Mathematics 260. One course. *Staff*

271. Algebraic Topology. (QR) Fundamental group and covering spaces, homology groups of cell complexes, classification of compact surfaces, the cohomology ring and Poincaré duality for manifolds. Prerequisites: Mathematics 171S and 200 or equivalents. One course. *Staff*

273. Algebraic Geometry. (QR) Local theory: affine varieties, algebraic and topological theory of singularities. Global theory over the complex numbers: Riemann surfaces, Jacobians, Kähler manifolds, Hodge theory, theorems of Lefschetz and Kodaira. Prerequisite: Mathematics 261 or equivalent. One course. *Staff*

275. Differential Geometry. (QR) Differentiable manifolds, fiber bundles, connections, curvature, characteristic classes, Riemannian geometry including submanifolds and variations of the length integral, complex manifolds, homogeneous spaces. Prerequisites: Mathematics 204 and 260 or equivalents. One course. *Staff*

276. Topics in Differential Geometry. (QR) Lie groups and related topics, Hodge theory, index theory, minimal surfaces, Yang-Mills fields, exterior differential systems, several complex variables. Prerequisite: Mathematics 275 or consent of instructor. One course. *Staff*

277. Topics in Algebraic Geometry. (QR) Projective varieties and the theory of extremal rays, classification of surfaces and higher-dimensional varieties, variation of

Hodge structure and moduli problems, schemes and arithmetic varieties, or other advanced topics. Prerequisite: Mathematics 273 or consent of instructor. One course. *Staff*

278, 279. Topics in Topology. (QR) Point set, algebraic, geometric, or differential topology. Consent of instructor required. One course each. *Staff*

281. Real Analysis I. (QR) Measures; Lebesgue integral; L^p spaces; Daniell integral, differentiation theory, product measures. Prerequisite: Mathematics 204 or equivalent. One course. *Staff*

282. Real Analysis II. (QR) Metric spaces, fixed point theorems, Baire category theorem, Banach spaces, fundamental theorems of functional analysis, Fourier transform. Prerequisite: Mathematics 281 or equivalent. One course. *Staff*

284. Topics in Functional Analysis. (QR) Advanced spectral analysis, operator algebras, nonlinear functional analysis, or structure theory of Banach spaces. Prerequisite: Mathematics 282 or equivalent. One course. *Staff*

285. Complex Analysis. (QR) Complex calculus, conformal mapping, Riemann mapping theorem, Riemann surfaces. Prerequisite: Mathematics 204 or equivalent. One course. *Staff*

286. Topics in Complex Analysis. (QR) Geometric function theory, function algebras, several complex variables, uniformization, or analytic number theory. Prerequisite: Mathematics 285 or equivalent. One course. *Staff*

290. Probability. (QR) Random variables, independence, expectations, laws of large numbers, central limit theorem, Markoff chains. Prerequisite: Mathematics 281 or equivalent. C-L: Statistics 207. One course. *Staff*

293. Topics in Probability Theory. (QR) Brownian motion, diffusion processes, random walks, and applications to differential equations and mathematical physics. Prerequisite: Mathematics 290 or consent of instructor. C-L: Statistics 297. One course. *Staff*

295. Fourier Analysis and Distribution Theory. (QR) Tempered distributions, Fourier transforms, classical inequalities, and oscillatory integrals. Prerequisites: Mathematics 204 and 285 or equivalents. One course. *Staff*

296. Ordinary Differential Equations. (QR) Existence and uniqueness theorems for nonlinear systems, well-posedness, two-point boundary value problems, phase plane diagrams, stability, dynamical systems, and strange attractors. Prerequisites: Mathematics 104, 111 or 131, and 203 or 139. One course. *Staff*

297. Partial Differential Equations I. (QR) Fundamental solutions of linear partial differential equations, hyperbolic equations, characteristics, Cauchy-Kowalevski theorem, propagation of singularities. Prerequisite: Mathematics 204 or equivalent. One course. *Staff*

298. Partial Differential Equations II. (QR) Elliptic boundary value problems, regularity theorems, the diffusion equation, and nonlinear equations. Prerequisite: Mathematics 297 or equivalent. One course. *Staff*

299. Topics in Partial Differential Equations. (QR) Hyperbolic conservation laws, pseudo-differential operators, variational inequalities, theoretical continuum mechanics. Prerequisite: Mathematics 298 or equivalent. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

31X. Introductory Honors Calculus I. (QR)

- 33, 34. Introductory Calculus with Digital Computation. (QR)
- 71S. Special Topics in Mathematics: For First- and Second-Year Students. (QR)
- 72S. Special Topics in Mathematics: For First- and Second-Year Students. (QR)
- 106. Linear Algebra with Digital Computation. (QR)
- 140. Advanced Calculus II. (QR)
- 140S. Advanced Calculus II. (QR)
- 171S. Elementary Topology. (QR)
- 234. Mathematics for Quantum Mechanics. (QR)
- 235. Topics in Mathematical Physics. (QR)
- 239. Topics in Applied Mathematics. (QR)
- 250. Introductory Mathematical Logic. (QR)
- 280. Differential Analysis. (QR)
- 283. Linear Operators. (QR)
- 288, 289. Topics in Analysis. (QR)
- 294. Topics in Probability Theory. (QR)

THE MAJOR

The Department of Mathematics publishes a handbook to guide majors in selecting courses for various areas of interest. A copy may be obtained from the Director of Undergraduate Studies.

For the A.B. Degree

Prerequisites: Mathematics 103 and 104 or the equivalent. (Many upper-level mathematics courses assume programming experience at the level of Computer Science 10. Students without computer experience are encouraged to take Computer Science 50.)

Major Requirements: Six courses in mathematics numbered above 111 including Mathematics 121 or 200 and Mathematics 139 or 203.

For the B.S. Degree

Prerequisites: Mathematics 103 and 104 or the equivalent. (Many upper-level mathematics courses assume programming experience at the level of Computer Science 10. Students without computer experience are encouraged to take Computer Science 50.)

Major Requirements: Eight courses in mathematics numbered above 111 including: Mathematics 121 or 200; Mathematics 139 or 203; and one of Mathematics 136, 140, 181, 204, 205. Also, Physics 41L, 42L or Physics 51L, 52L or Physics 53L, 54L.

Honors/Distinction

The department offers a program for graduation with distinction for majors under the curriculum affecting students who matriculated before May 1988 and a program for Latin honors by honors project for students who matriculated thereafter. See the section on honors in this bulletin and also the *Handbook for Majors*.

Medicine (School)—Graduate (School) Basic Science Courses Open to Undergraduates

Qualified students in arts and sciences may select courses from the following offered by the graduate departments associated with the School of Medicine. A major is not

offered to undergraduates in any of the departments listed below; nor do the courses count toward area of knowledge requirements. For permission to register for these courses and for further information, see Professors Hsieh (biochemistry), Padilla (cell biology), Corley (immunology), Willett (microbiology), W. C. Hall (neurobiology), Bigner (pathology), or Schwartz (pharmacology). The 200-level courses below are described in the Bulletin of Duke University: Graduate School.

Biochemistry (BCH)

- 209, 210. Independent Study. One or two courses. *Staff*
- 215. Genetic Mechanisms. Prerequisite: introductory biochemistry. C-L: The University Program in Genetics. One course. *Webster and staff*
- 219. Molecular and Cellular Bases of Differentiation. C-L: Cell Biology 219, Immunology 219, Microbiology 219, and Pathology 219. One course. *Counce and staff*
- 222. Structure of Biological Macromolecules. Half course. *Richardson*
- 227. Introductory Biochemistry I. Prerequisite: organic chemistry. One course. *Hill, Greenleaf, and Rajagopalan*
- 228. Introductory Biochemistry II. Prerequisites: organic chemistry and Biochemistry 227. One course. *Fridovich and Webster*
- 259. Molecular Biology I: Proteins and Enzymes. C-L: Cell Biology 259, Immunology 259, Microbiology 259, and the University Program in Cell and Molecular Biology. One course. *Richardson and staff*
- 265S, 266S. Seminar. Topics and instructors announced each semester. Half course or variable. *Staff*
- 268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and Biochemistry 259 or consent of instructor. C-L: Cell Biology 268, Immunology 268, Microbiology 268, The University Program in Cell and Molecular Biology, and The University Program in Genetics. One course. *Steege and staff*
- 291. Physical Biochemistry. Prerequisites: undergraduate physical chemistry and one year of calculus. One course. *Oas and staff*

Courses Currently Unscheduled

- 245L. Macromolecules, Ecology, and Evolution
- 276L. Comparative and Evolutionary Biochemistry

Cell Biology (CBI)

- All courses require the consent of the Director of Undergraduate Studies.
- 202. Medical Physiology. Limited to students whose training requires knowledge of human physiology as it pertains to medicine. Four lectures, one conference, and one clinical correlation per week. Open to undergraduates only with consent of course leader. Students may take either 202 or 203-204, but not both, for credit. One course. *N. Anderson and staff*
- 203. Introduction to Physiology. Consent of instructor required. Students may take either 202 or 203-204, but not both, for credit. One course. *Blum and staff*
- 204. Cell and Molecular Physiology. (Continuation of 203.) Prerequisite: consent of instructor. One course. *Blum and staff*
- 205. Design and Analysis of Biological Experiments. One course. *Lobaugh*
- 208. Cellular Neurobiology. Consent of instructor required. C-L: Neurobiology 208. *Augustine, Simon, and Wong*
- 210. Independent Study. Variable credit. *Staff*
- 211. Cellular Mechanisms of Injury. Prerequisite: consent of instructor. One course. *Staff*
- 212. Topics in Reproductive Biology. Prerequisite: Biology 160 or equivalent. *N. Anderson, Saling, Schomberg, and Tyrey*
- 213. Oxygen and Physiological Function. Half course. *Jöbsis*
- 215. Seminar in the Physiology of Disease. Half course. *Mandel and guest faculty*
- 219. Molecular and Cellular Bases of Differentiation. C-L: Biochemistry 219, Immunology 219, Microbiology 219, and Pathology 219. One course. *Counce and staff*
- 223. Cellular and Integrative Cardiovascular Physiology and Biophysics. Consent of instructor required. Prerequisites: Cell Biology 203 or equivalent and Physics 52L or equivalent. C-L: Biomedical Engineering 223. One course. *Benjamin and staff*
- 232. Extracellular Matrix and Cell Adhesion. Half course. *Bennett and Erickson*
- 235, 235L. Advanced Research Training in Marine Molecular Biology and Biotechnology. Offered at Beaufort. One course, one and one half courses respectively. *C. Bonaventura and staff*
- 236S. Seminar on the Cellular and Molecular Biology of Skeletal Muscle. One course. *Schachat*
- 237. Analytical Imaging in Biomedical Research. One course. *Ingram, Kopf, and LeFurgey*
- 243. Environmental Biochemistry. Given at Beaufort. Prerequisite: organic chemistry. C-L: Environment 243. One course. *Bonaventura and Brouwer*
- 244. Cellular and Molecular Research Techniques. Given at Beaufort. Prerequisite: organic chemistry. C-L: Environment 244. One course. *Bonaventura and Brouwer*

259. Molecular Biology I: Proteins and Enzymes. Prerequisite: consent of instructor. C-L: Biochemistry 259, Immunology 259, Microbiology 259, and The University Program in Cell and Molecular Biology 259. One course. *Richardson and staff*

268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and Cell Biology 259 or consent of instructor. C-L: Biochemistry 268, Immunology 268, Microbiology 268, The University Program in Cell and Molecular Biology, and The University Program in Genetics. One course. *Steege and staff*

269. Advanced Cell Biology. C-L: Biology 269 and The University Program in Cell and Molecular Biology 269. One course. *McClay and staff*

270S. Molecular and Cellular Adaptations of Marine Organisms. Given at Beaufort. Half course. C. Bonaventura

Courses Currently Unscheduled

217. Membrane Transport

Immunology (IMM)

214. Fundamentals of Electron Microscopy. Prerequisites: introductory biology and consent of instructor. C-L: Microbiology 214. One course. *Müller*

219. Molecular and Cellular Bases of Differentiation. C-L: Biochemistry 219, Cell Biology 219, Microbiology 219, and Pathology 219. One course. *Counce and staff*

244. Principles of Immunology. An introduction to the molecular and cellular basis of the immune response. Topics include anatomy of the lymphoid system, lymphocyte biology, antigen-antibody interactions, humoral and cellular effector mechanisms, and control of immune responses. Prerequisites: Biology 160 and Chemistry 152L and consent of instructor. C-L: Biology 244. One course. *Kostyu, McClay, and staff*

246S. Parasitic Diseases. Prerequisites: Immunology 244 or 291, and Biochemistry 227 or equivalent. C-L: Microbiology 246S. One course. *Balber*

259. Molecular Biology I: Proteins and Enzymes. C-L: Biochemistry 259, Cell Biology 259, Microbiology 259, and The University Program in Cell and Molecular Biology 259. One course. *Richardson and staff*

268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and Biochemistry 259 or consent of instructor. C-L: Biochemistry 268, Cell Biology 268, Microbiology 268, The University Program in Cell and Molecular Biology and The University Program in Genetics. One course. *Steege and staff*

269. Advanced Cell Biology. Prerequisite: introductory cell biology or consent of instructor. C-L: Biology 269, Cell Biology 269, Microbiology 269, and The University Program in Cell and Molecular Biology 269. One course. *McClay and staff*

Microbiology (MIC)

209, 210. Independent Study. A laboratory or library project. Prerequisite: consent of Director of Undergraduate Studies and instructor. Credit to be arranged. *Staff*

214. Fundamentals of Electron Microscopy. Prerequisites: introductory biology and consent of instructor. One course. *Müller*

219. Molecular and Cellular Bases of Differentiation. C-L: Biochemistry 219, Cell Biology 219, Immunology 219, and Pathology 219. One course. *Counce and staff*

221, 221L. Medical Microbiology. Prerequisite: consent of instructor. One course, one and one half courses respectively. *Willett and staff*

246S. Parasitic Diseases. Prerequisites: Immunology 244 or 291, and Biochemistry 227 or equivalent. C-L: Immunology 246S. One course. *Balber*

259. Molecular Biology I: Proteins and Enzymes. C-L: Biochemistry 259, Cell Biology 259, Immunology 259, and The University Program in Cell and Molecular Biology 259. One course. *Richardson and staff*

268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and Biochemistry 259 or consent of instructor. C-L: Biochemistry 268, Cell Biology 268, Immunology 268, The University Program in Cell and Molecular Biology, and The University Program in Genetics. One course. *Steege and staff*

269. Advanced Cell Biology. Prerequisite: introductory cell biology or consent of instructor. C-L: Biology 269, Cell Biology 269, Immunology 269, and The University Program in Cell and Molecular Biology 269. One course. *McClay and staff*

Neurobiology (NBI)

189S. Building the Brain. Open only to juniors and seniors. See C-L: Distinguished Professor Course 189S; also C-L: Human Development, Neurosciences, and Psychology 189S. One course. *Purves*

208. Cellular Neurobiology. Consent of instructor required. C-L: Cell Biology 208. One course. *Augustine, Kauer, and Reinhart*

209. Systems Neurobiology. Prerequisite: consent of instructor. One course. *Cant and Fitzpatrick*

211. Developmental Neurobiology. Consent of instructor required. One course. *Katz, LaMantia, and Purves*

212. Molecular Neurobiology. Consent of instructor required. One course. *Lo, Matthew, and Skene*

213. Neurobiology of Disease. One course. *Strittmatter, Turner, and staff*
 214. The Neural Basis for Sensory-Motor Integration. Consent of instructor required. One course.
Diamond and W. C. Hall

Courses Currently Unscheduled

- 266S. Comparative Neurobiology

Pathology (PTH)

All courses require consent of instructor and Director of Graduate Studies.

- 209, 210. Independent study. Prerequisite: senior standing. Credit to be arranged. *Staff*
 219. Molecular and Cellular Bases of Differentiation. C-L: Biochemistry 219, Cell Biology 219, Immunology 219, and Microbiology 219. One course. *Counce and staff*
 258. Cellular and Subcellular Pathology. Half course. *Shelburne and Sommer*
 275. Fundamentals of Electron Microscopy and Biological Microanalysis. One course. *Brody, Ingram, Shelburne, and Sommer*

Pharmacology (PHR)

150. Pharmacology: Drug Actions and Reactions. Mechanisms of drug action, concepts of drug toxicity, resistance, tolerance and drug interactions. Examples of how drugs affect the autonomic and central nervous systems, the cardiovascular and endocrine systems, and how drugs treat infection and cancer. Prerequisites: introductory biology (Biology 21L, 22L) and chemistry (Chemistry 11L, 12L). One course. *Schwartz*

160. Drugs, Brain, and Behavior. Mechanisms by which psychoactive drugs act. Changes which occur with chronic use of drugs; drug abuse and dependence. Social and legal implications of psychoactive drugs. Prerequisites: introductory biology (Biology 21L, 22L) and chemistry (Chemistry 11L, 12L). C-L: Psychology 127. One course. *Kuhn*

191, 192. Independent Study. For juniors and seniors with consent of Director of Undergraduate Studies and supervising instructor. Variable credit. *Staff*

233. Essentials of Pharmacology. Prerequisites: introductory biology; Chemistry 151L; Mathematics 31, 32. One course. *Slotkin and staff*

254. Mammalian Toxicology. Prerequisites: introductory biology and Chemistry 151L, or consent of instructor. One course. *Abou-Donia and staff*

Medieval and Renaissance Studies Program (MED)

Professor Witt, Chair and Director of Undergraduate Studies

A major is available in this program.

The program in Medieval and Renaissance Studies is designed to provide the student with a well-rounded understanding of the historical, cultural, and social forces that shaped the medieval and Renaissance periods. The program is divided into four areas of study: fine arts (art and musicology); history; language and literature (English, French, German, Greek, Italian, Latin, and Spanish); and philosophy-religion. An interdisciplinary major is offered. See the section on the major below.

MEDIEVAL AND RENAISSANCE COURSES

21S. First-Year Seminar: Topics in Medieval Studies. Topics vary according to instructor: perspectives from history, literature, religion, philosophy, and the arts. One course. *Staff*

22S. First-Year Seminar: Topics in Renaissance Studies. Topics vary according to instructor: perspectives from history, literature, religion, philosophy, and the arts. One course. *Staff*

114. Aspects of Medieval Culture. (CZ) A study of historical, literary, philosophical, and art historical materials introducing medieval culture and the methods developed for its study. C-L: Art 139, Classical Studies 139, and History 116. One course. *Bruzellius, Solterer, and Witt*

115. Aspects of Renaissance Culture. (CZ) A study of historical, literary, philosophical, and art historical materials introducing Renaissance culture and the methods developed for its study. C-L: Art 149 and History 148. One course. *L. Patterson, Rasmussen, Van Miegroet, and Witt*

160S. Topics in Medieval and Renaissance Studies. Interdisciplinary perspectives from the arts, history, literature, philosophy, and religion. For juniors and seniors and Medieval and Renaissance Studies majors, or with consent of instructor. Prerequisite: one course in Medieval and/or Renaissance periods. One course. *Staff*

200S. Seminar in Medieval and Renaissance Studies. (CZ) Topics in the historiography and interpretation of medieval and Renaissance culture. Topics will vary from year to year. One course. *Staff*

OTHER COURSES AVAILABLE IN THE PROGRAM AND DESCRIBED UNDER THE LISTINGS OF THE DEPARTMENTS SPECIFIED BELOW

Art and Art History

- 129. The History of Prints and Printmaking. *Rice*
- 131. Art of the Early Middle Ages. *Bruzelius or Wharton*
- 132. Art of the Late Middle Ages. *Bruzelius or Wharton*
- 134. Medieval Architecture. *Bruzelius*
- 135. Gothic Cathedrals. *Bruzelius*
- 140. Giotto and the Origins of the Renaissance. *Staff*
- 141. Fifteenth-Century Italian Art. *Rice*
- 142. Sixteenth-Century Italian Art. *Rice*
- 145. Renaissance Art in Florence. *Rice*
- 146. Italian Renaissance Architecture. *Rice*
- 148. Art of the Netherlands in the Fifteenth Century. *Van Miegroet*
- 150/250. Italian Baroque Architecture. *Rice*
- 152. Art of the Netherlands in the Sixteenth Century. *Van Miegroet*
- 153. Art of the Northern Netherlands in the Seventeenth Century. *Van Miegroet*
- 154. German Art in the Fifteenth and Sixteenth Centuries. *Van Miegroet*
- 156. Art of the Southern Netherlands in the Seventeenth Century. *Van Miegroet*
- 216. The Art of the Counter-Reformation. *Rice*
- 233S. Topics in Early Christian and Byzantine Art. *Wharton*
- 236S. Topics in Romanesque and Gothic Art and Architecture. *Bruzelius*
- 243S. Topics in Netherlandish and German Art. *Van Miegroet*
- 247S. Topics in Italian Renaissance Art. *Rice*
- 260S. Topics in Italian Baroque Art. *Rice*

Classical Studies

- 117. Ancient Myth in Literature. *Newton*

English

- 113A. Introduction to Old English. *Staff*
- 113B. Old English Literature. *Staff*
- 121. Medieval English Literature to 1500. *L. Patterson*
- 122. Sixteenth-Century English Literature. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*
- 123. English Literature: 1600 to 1660. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*
- 140, 141. Chaucer. *DeNeef, Gopen, or L. Patterson*
- 143, 144. Shakespeare. *DeNeef, Gopen, Jones, A. Patterson, Porter, Randall, or Valbuena*
- 145. Milton. *Fish, A. Patterson, Price, or Schwartz*
- 207A. Introduction to Old English. *Staff*
- 207B. Old English Literature. *Staff*
- 208. History of the English Language. *Butters or Tetel*
- 212. Middle English Literature: 1100 to 1500. *L. Patterson*
- 213, 214. Chaucer. *L. Patterson*
- 221. Renaissance Prose and Poetry: 1500 to 1660. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*
- 225. Renaissance Drama: 1500 to 1642. *A. Patterson or Randall*

French

- 145S. Topics in Renaissance Literature and Culture. *Tetel*
- 146S. Montaigne and Self-Portraiture. *Tetel*
- 148. French Drama of the Seventeenth Century. *Farrell*
- 211. History of the French Language. *Thomas*

German

- 201. Introduction to Middle High German. *Rasmussen*
- 202S. Medieval Seminar. *Rasmussen*
- 203S. Sex, Gender, and Love in Middle High German Literature. *Rasmussen*
- 210S. Renaissance and Reformation. *Borchardt*

- 215S. German Baroque Literature. *Borchardt*
- 260. History of the German Language. *Rasmussen*

History

- 107A, 107B. History of England. *Cell or Herrup*
- 116. Aspects of Medieval Culture. *Bruzdius, Solterer, and Witt*
- 117. Early Modern Europe. *Neuschel*
- 133. Medieval Europe, 300-1400. *Green*
- 138. Renaissance and Reformation Germany. *Robisheaux*
- 148. Aspects of Renaissance Culture. *L. Patterson, Rasmussen, Van Miegroet, and Witt*
- 151A. The Intellectual Life of Europe, 1250-1600. *Witt*
- 173. History of Spain from Late Medieval Times to the Present. *TePaske*
- 174. History of Colonial Hispanic America from Pre-Columbian Times to the Wars of Independence.

TePaske

- 195S.13, 196S.13. Problems in Early Modern English History. *Herrup*
- 195S.37. Before Columbus. *Green*
- 196S.41. Women in Medieval Society. *Green*
- 221. Topics in the Social and Economic History of Europe, 1200-1700. *Robisheaux*
- 222. Problems in the Intellectual History of the European Renaissance and Reformation. *Witt*
- 237S. Europe in the Early Middle Ages. *Staff*
- 238S. Europe in the High Middle Ages. *Staff*
- 267S. England in the Sixteenth Century. *Herrup*
- 268S. England in the Seventeenth Century. *Herrup*

Italian

- 101. Introduction to Italian Literature. *Caserta or Finucci*
- 145S. Topics in Renaissance Literature and Culture. *Finucci*
- 284, 285. Dante. *Caserta*

Latin

- 221. Medieval Latin. *Newton*

Music

- 155S. Music History I: Antiquity, Middle Ages, Early Renaissance. *Brothers or Seebass*
- 156S. Music History II: Late Renaissance, Baroque. *Barilet, Brothers, Meniker, Seebass, or Silbiger*
- 211. Notation. *Williams*
- 222. Music in the Middle Ages. *Brothers or Seebass*
- 223. Music in the Renaissance. *Brothers or Silbiger*

Philosophy

- 119. Medieval Philosophy. *Mahoney*
- 120. Late Medieval and Renaissance Philosophy. *Mahoney*
- 218S. Medieval Philosophy. *Mahoney*
- 219S. Late Medieval and Renaissance Philosophy. *Mahoney*

Religion

- 134. Jewish Mysticism. *Bland*
- 162. Introduction to Islamic Civilization. *Lawrence and staff*

Spanish

- 151. Spanish Literature of the Renaissance and the Baroque. *Ross or Wardropper*
- 210. History of the Spanish Language. *Garci-Gómez*

THE MAJOR

A major consists of at least eight courses drawn from the non-introductory courses of the four areas of study (fine arts, history, language and literature, and philosophy-religion). Three courses in each of two areas must be included. Besides the courses specifically listed (under Medieval and Renaissance Courses and departmental headings) in the Medieval and Renaissance periods, provision may be made for independent study in any of the four areas.

Each program is tailored to the needs and interests of the student under the supervision of a committee consisting of faculty members from appropriate departments. After discussion with the Director of Undergraduate Studies for Medieval and Renaissance Studies, the student submits a provisional program of study outlining special interdisciplinary interests. Normally the program is planned well before the end

of the sophomore year to allow time to acquire a working knowledge of languages pertinent to specific interests.

Microbiology (MIC)

For courses in Microbiology, see Medicine (School)—Graduate (School) Basic Science Courses Open to Undergraduates.

Military Science—Army ROTC (MSC)

Professor Guild, Lieutenant Colonel, U.S. Army, *Chair*; Visiting Assistant Professor Billings, Captain, U.S. Army, *Director of Undergraduate Studies*; Visiting Assistant Professor Lindeman, Major, U.S. Army, *Supervisor of Freshman Instruction*; Visiting Assistant Professors Petzrick, Major, U.S. Army and Hite, Captain, U.S. Army

The Department of Military Science offers students from all disciplines within the University the opportunity to study the following subjects: leadership (theory and practice), management (time, personnel, and materiel), ethics and the military profession, the role and responsibility of the military in a democratic society, the philosophy and practice of military law, and strategy and tactics.

The Army ROTC program is made up of a two-year basic course of study (freshman and sophomore level) which is taken without obligation by nonscholarship students, and a two-year advanced course of study (junior and senior level) which includes a six-week advanced camp, usually completed during the summer prior to the senior year. Direct entry into the advanced course is sometimes permitted if an applicant has previous military training or experience, or when a six-week basic camp is completed. To be eligible for participation in the advanced course, students must successfully complete the basic course (unless direct entry is permitted), be physically qualified, be of good moral character, have a minimum of two years remaining as a student (undergraduate or graduate level, or a combination), and sign a contract to accept a commission in the United States Army, the Army National Guard, or the Army Reserve as directed by the Secretary of the Army.

Laboratory is mandatory each semester for scholarship cadets and nonscholarship cadets in their second or later semester of ROTC. Some specific laboratories are required for non-ROTC students taking Military Science 51, 52, and 113. Students should consult the Department of Military Science (telephone 1-919-684-5895 collect, or 1-800-222-9184, toll free) for more detailed information. Also see the Army Reserve Officers' Training Corps section under Special Programs in this bulletin.

1L. Fall Semester Laboratory. Drill and ceremonies, marksmanship training, land navigation exercises, first aid, and confidence course training. Mandatory for Army ROTC scholarship cadets and nonscholarship cadets in their second or later semester of ROTC who are enrolled in Military Science 11, 51, 113, and 151. Must be repeated with each course. No credit. *Petzrick*

2L. Spring Semester Laboratory. Drill and ceremonies, communications, and tactical exercises. Mandatory for Army ROTC scholarship cadets and nonscholarship cadets in their second or later semester of ROTC who are enrolled in Military Science 12, 52, 114, and 152. Must be repeated with each course. No credit. *Petzrick*

11. Introduction to ROTC and the Army. The military organization with emphasis on tradition, doctrine, and contribution to national objectives. Laboratory required for ROTC scholarship cadets only. Half course. *Lindeman*

12. The Military Profession. Introduction to the concept of the military as a profession. Questions of ethics and values in the military; the issue of war and morality. Laboratory required for ROTC cadets only. Half course. *Lindeman*

51. Military Topography. Interpretation and use of topographical maps to facilitate land navigation. Consideration of the military significance of terrain. Laboratory required for Army ROTC cadets only, with minor exceptions. Half course. *Billings*

52. Introduction to Small Unit Tactics. Introduction to planning, organizing, and conducting small unit offensive and defensive operations. Consideration of the principles of war. Laboratory required for Army ROTC cadets only, with minor exceptions. Half course. *Billings*

113. Advanced Military Operations. Fundamentals of the conduct of military operations including advanced military topography; unit movements; route planning; nuclear, biological, and chemical defense; and military communications. Laboratory required for Army ROTC cadets only. Prerequisite: Military Science 51. One course. *Petrzick*

114. Advanced Tactical Applications. Study of threat forces to include doctrine, organization, equipment, and training. Conduct of platoon offensive, defensive, and patrolling operations for Army infantry units. Laboratory required for Army ROTC cadets only. Prerequisite: Military Science 52. One course. *Petrzick*

151. Military Justice and the Law of War. Introduction to the Uniform Code of Military Justice and its relationship to the American legal system. Theory and practice of the law of war as embodied in the Geneva, Hague, and other agreements. Laboratory required for Army ROTC cadets only. One course. *Guild*

152. Leadership and Command Management. Theory and practice of leadership and military management techniques for mission accomplishment. Laboratory required for Army ROTC cadets only. One course. *Guild*

191. Independent Study. Directed readings and research in military science. One course. *Billings*

Music (MUS)

Professor Silbiger, *Chair*; Associate Professor of the Practice Parkins, *Director of Undergraduate Studies*; Professors Seebass, Todd, and Williams; Associate Professors Bartlett and Jaffe; Assistant Professors Brothers, Gilliam, Henry, and Lindroth; Associate Professors of the Practice Jeffrey, Szász, and Wynkoop; Assistant Professors of the Practice Muti and Votta; Adjunct Assistant Professor Druesedow; Lecturer Meniker; Artists-in-Residence Bagg, Berg, Ku, Love, Raimi, and Troxler; Staff Associates Crawford, Dimsdale, Eagle, Gilmore, Hanks, Hawkins, Jensen, Lail, Link, Mizesko, Pederson, Tektonidis, and Weddle

A major is available in this department.

For over two thousand years, music has been viewed as a crucial part of education, compulsory in some cultures, optional in many, formative in all. Music is customarily regarded as an art, but as a university subject it has its own scientific language, logic, and grammar, in the understanding of which the mind is stretched and tested. Furthermore, music as taught at Duke includes assumptions that history, theory, composition, and performance are areas of comparable worth both in themselves and as a means of understanding the many facets of musicianship. Almost every student has some personal involvement with music (often with the many kinds of music), and the courses aim to further that involvement, whether passive or active, a simple hobby or a compelling force.

Courses include many kinds of instruction: applied lessons, history and theory lectures, harmony classes, composition seminars, ensemble participation, practical laboratory work (such as ear-training), and coaching sessions for conductors. Emphasis is placed equally on theory and practice, and students' musical activity can vary widely

across the spectrum from composing their own music to endeavoring to understand the technical, historical, and sociological context of other composers' music.

Musical studies can have a particular value in Program II. So many areas of interest in literature (English and world literature), the arts, art history, sociology, politics, philosophy, religion, psychology, and physics are illustrated, paralleled, or elucidated by aspects of music, just as music itself is by those other disciplines.

THEORY, COMPOSITION, AND CONDUCTING

The department's theory courses are designed to give the student a deeper understanding of musical materials: harmony, counterpoint, voice leading, and musicianship. This is accomplished through analysis of repertoire, composition, aural work, and keyboard playing (score reading, figured bass, and simple improvisation).

36. Acoustics and Music. (NS) No previous knowledge of physics is assumed. See C-L: Physics 36. One course. *Lawson*

55. Introduction to Music Theory. (AL) Fundamentals of notation, melodic and harmonic practice, analysis, and score reading, as a basis for independent work. Does not count for major requirements. Prerequisite: some ability to read music. One course. *Troxler or staff*

65. Fundamentals of Music Theory. (AL) Physical properties of sound, principles of diatonic tonal organization, melodic and harmonic constructions, elementary counterpoint, and figured bass. Laboratory. Prerequisites: basic knowledge of musical notation and vocabulary. One course. *Lindroth or Parkins*

66. Tonal Harmony. (AL) Harmonic language of eighteenth and nineteenth centuries, functional chromaticism, and introduction to musical forms. Laboratory. Prerequisite: Music 65. One course. *Lindroth*

67S. Composition I. (AL) Composing original music in smaller forms for voice, piano, and other instruments. Studies in compositional techniques. Prerequisites: Music 65 and 66 or consent of instructor. One course. *Jaffe or Lindroth*

68S. Composition II. (AL) See Music 67S. Prerequisites: Music 65 and 66 or consent of instructor. One course. *Jaffe or Lindroth*

75. Jazz Improvisation. (AL) The theory of jazz improvisation for all instruments and its practical application to the different styles of jazz. Consent of instructor required. Half course. *Jeffrey*

115S. Modal Counterpoint. (AL) Polyphonic practice of the fifteenth and sixteenth centuries; sacred and secular music. Laboratory. Prerequisite: Music 66 or consent of instructor. One course. *Williams*

116S. Counterpoint. (AL) Polyphonic practice from the sixteenth through the twentieth centuries; sacred and secular music. Laboratory. Prerequisite: Music 66 or consent of instructor. One course. *Jaffe or Williams*

117S. Form, Analysis, and Compositional Techniques. (AL) Analytical studies and compositional exercises in various forms, techniques, and styles with an emphasis on nineteenth- and twentieth-century music. Laboratory. Prerequisite: Music 66 or consent of instructor. One course. *Staff*

123. Musicianship I. Development of practical musical skills: sight singing, ear training, and keyboard proficiency. Prerequisite: for music majors, Music 66; for non-majors, consent of instructor. Half course. *Staff*

124. Musicianship II. Prerequisite: Music 123. Half course. *Parkins or staff*

128. Instrumental Conducting. (AL) Development of techniques of conducting instrumental ensembles with emphasis on orchestral repertoire. Score-reading and analysis, principles of interpretation, and practical conducting experience. Prerequisite: Music 66 or consent of instructor. One course. *Muti or Votta*

129. Choral Conducting. (AL) Development of techniques of conducting vocal repertoire, ranging from church anthems to large-scale works. Score-reading and analysis, principles of interpretation, and practical conducting experience. Prerequisite: Music 66 or consent of instructor. One course. *Wynkoop*

HISTORY, LITERATURE, AND MUSICOLOGY

The study of music history and literature contributes to a broader knowledge of culture and society. Courses offer students the opportunity to examine compositions in their historic and/or social context. In addition to surveying significant forms, genres, and styles, and their development, the courses include consideration of music's function, the place of musicians, aspects of performance practice, and aesthetic value. Although the normal prerequisite for Music 155S-158S (Music History I-IV) is Music 65, interested students in other disciplines with some background in music are encouraged to ask individual instructors for permission to enroll.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

74. Introduction to Jazz. (AL) A survey examining musical, aesthetic, sociological, and historical aspects. For nonmajors. C-L: African and Afro-American Studies 74. One course. *Jeffrey*

119. The Humanities and Music. (AL) A historical survey of the relationship of significant literary texts to music, exemplifying literary genres and concepts with musical works from antiquity to the nineteenth century. Readings from primary literary sources, listening to representative musical settings. Does not count for the major in music. C-L: Comparative Area Studies. One course. *Bartlet or Seebass*

120S. Women in Music. (CZ) The lives and works of the principal women composers and musicians of Western art music from the Middle Ages to the present within their contemporary intellectual, artistic, sociological, and economic contexts. The extent to which gender as an historical variable affected their creative activities and achievements as well as the critical assessment of their canon. C-L: Comparative Area Studies and Women's Studies. One course. *Staff*

125. Masterworks of Music. (AL) An introduction to the lives and works of major Western composers. For nonmajors. One course. *Henry, Muti, Silbiger, or Todd*

125D. Masterworks of Music. (AL) Same as Music 125 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Gilliam or Votta*

136S. Introduction to Non-Western Music. (AL) Study of social and religious contexts. Native instruments and related craftsmanship. C-L: Comparative Area Studies. One course. *Seebass*

138. Music in East and Southeast Asia. (AL) An introduction to the musical culture of Japan, China, mainland Southeast Asia, Indonesia, and the Philippines. Notation, performance, and musical instruments; historical, religious, and social context. C-L: Comparative Area Studies. One course. *Seebass*

140S. Ascendancy of the Jazz Solo. (AL) Development of the jazz solo from the 1920s through the 1940s. Examination of this music through listening and transcriptions.

Prerequisites: ability to read music, and Music 74 or consent of instructor. C-L: African and Afro-American Studies 140S. One course. *Brothers*

143. Beethoven and His Time. (AL) The music of Beethoven and its relation to contemporary historical, social, and literary developments. Emphasis on the nine symphonies. C-L: Comparative Area Studies. One course. *Bartlet, Gilliam, Silbiger, or Todd*

144. Bach and His Time. (AL) The music of Johann Sebastian Bach and its historical and cultural background, with emphasis on the sacred and the instrumental works. Some consideration also given to the music of Bach's contemporaries, including Vivaldi, Rameau, and Handel. C-L: Comparative Area Studies. One course. *Meniker or Silbiger*

145. Mozart and His Time. (AL) A biographical sketch and a study of his works in their relationship to the past and to works of contemporaries in various European countries. C-L: Comparative Area Studies. One course. *Seebass or Silbiger*

147. Verdi and Italian Romantic Opera. (AL) The operas of Giuseppe Verdi, from early works closely connected with the Risorgimento to later masterworks like *Otello*, considered in relation to his Italian predecessors and contemporaries. Includes the study of musical scores, dramatic aspects, and literary background, as well as artistic and social conventions. One course. *Muti*

155S. Music History I: Antiquity, Middle Ages, Early Renaissance. (AL) Prerequisite: for music majors, Music 65 or consent of instructor; for nonmajors, consent of instructor. C-L: Medieval and Renaissance Studies. One course. *Brothers or Seebass*

156S. Music History II: Late Renaissance, Baroque. (AL) Prerequisite: for music majors, Music 65 or consent of instructor; for nonmajors, consent of instructor. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Bartlet, Brothers, Meniker, Seebass, or Silbiger*

157S. Music History III: Rococo and Classic. (AL) Prerequisite: for music majors, Music 65 or consent of instructor; for nonmajors, consent of instructor. C-L: Comparative Area Studies. One course. *Bartlet, Seebass, Silbiger, or Todd*

158S. Music History IV: Romanticism and the Modern Period. (AL) Prerequisite: for music majors, Music 65 or consent of instructor; for nonmajors, consent of instructor. C-L: Comparative Area Studies. One course. *Bartlet, Gilliam, Silbiger, or Todd*

166. Opera. (AL) History of opera from the late sixteenth century to the present. Relationship of music and text; opera as social commentary; changing forms and styles. Selected composers, especially Mozart, Verdi, Puccini, and Wagner. One course. *Bartlet or Muti*

167. Symphonic Literature. (AL) An investigation of the symphony, tone poem, and symphonic suite from seventeenth-century antecedents to the orchestral repertoire of the present century. One course. *Henry*

168. Piano Music. (AL) The two-hundred-year tradition of music for the piano, the evolution of the instrument, and its principal composers (including Mozart, Beethoven, Chopin, Liszt, Brahms, and other major figures up to the present day). Performance traditions, the role of virtuosity, and improvisation. One course. *Todd*

171S. Bach: Master of Style. (AL) Consent of instructor required. See C-L: Distinguished Professor Course 194S. One course. *Williams*

185S, 186S. Seminar in Music. (AL) Primarily for junior and senior music majors. Topics to be announced. Consent of instructor required. One course each. *Staff*

187S, 188S. Seminar on Interpretation and Performance. (AL) Interpretative analysis of instrumental (piano, strings, winds) and vocal repertoire from baroque to modern composers. Participants expected to perform. Consent of instructor required. One course each. *Szász*

For Advanced Undergraduates and Graduates

201. Introduction to Musicology. (AL) Methods of research on music and its history, including studies of musical and literary sources, iconography, performance practice, ethnomusicology, and historical analysis, with special attention to the interrelationships of these approaches. One course. *Druesedow or Seebass*

203. Proseminar in Performance Practice. (AL) Critical methods in the study of historical performance practice, including the evaluation of evidence provided by musical and theoretical sources, archival and iconographic materials, instruments, and sound recordings. Current issues regarding the performance practice for music from the Middle Ages to the twentieth century. One course. *Meniker or Silbiger*

211, 212. Notation. (AL) Development and changing function of musical notation from c. 900 to c. 1900, including plainchant notations, black notations, white notations, the invention of printing (particularly movable type and engraving), keyboard and lute tablatures, scores. One course each. *Williams*

213. Theories and Notation of Contemporary Music. (AL) The diverse languages of contemporary music and their roots in the early twentieth century, with emphasis on the problems and continuity of musical language. Recent composers and their stylistic progenitors: for example Ligeti, Bartók, and Berg; Carter, Schoenberg, Ives, and Copland; Crumb, Messiaen, and Webern; Cage, Varèse, Cowell, and Stockhausen. One course. *Jaffe or Lindroth*

215. Music Analysis. (AL) Historical, philosophical, and ideological issues raised by music analysis. Intensive study of harmony and voice leading in the works of major tonal composers, with emphasis on the analytic approach of Heinrich Schenker. One course. *Todd*

217. Selected Topics in Analysis. (AL) An exploration of analytical approaches appropriate to a diversity of music, which may include settings of literary texts, pre-tonal music, and music in oral and vernacular traditions. Prerequisite: Music 215 or consent of instructor. One course. *Silbiger*

218. Advanced Counterpoint. (AL) Selected topics in modal or tonal contrapuntal practice with emphasis on music writing up to five parts. Consent of instructor required for students not registered for doctoral work in composition. One course. *Jaffe, Lindroth, or Williams*

222. Music in the Middle Ages. (AL) Selected topics. C-L: Medieval and Renaissance Studies. One course. *Brothers or Seebass*

223. Music in the Renaissance. (AL) Selected topics. C-L: Medieval and Renaissance Studies. One course. *Brothers or Silbiger*

224. Music in the Baroque Era. (AL) Selected topics. One course. *Silbiger or Williams*

225. Music in the Classic Era. (AL) Selected topics. One course. *Bartlet, Seebass, or Todd*

226. Music in the Nineteenth Century. (AL) Selected topics. One course. *Bartlet, Gilliam, or Todd*

227. Music in the Twentieth Century. (AL) Selected topics. One course. *Gilliam or Todd*

229. Collegium Musicum. A practicum in music of the Middle Ages and the Renaissance. Rehearsals are held weekly in preparation for public performances (usually one each semester). No credit. *Brothers*

230. Workshop in Performance Practice. Laboratory for application of historically informed performance practice on instruments appropriate to the period of the music studied. Emphasizes instrumental and vocal chamber music. Open to graduates and undergraduates with consent of instructor. No credit. *Meniker*

236. Nineteenth-Century Piano Music. (AL) Beethoven, Schubert, Weber, Mendelssohn, Schumann, Chopin, Liszt, and Brahms. The arts of improvisation and transcription, the keyboard virtuoso, the character piece, and the conflict between romantic content and form. One course. *Todd*

295S. Composition Seminar. (AL) Selected topics in composition. One course. *Jaffe or Lindroth*

296S. Analysis of Contemporary Music. (AL) Structures, expressive intentions, and functions since 1914. Contemporary orchestral music, American music, European music, popular media, musical tradition, and contemporary composers. Analysis of works performed in the department's Encounters Series with occasional guest composers present. One course. *Jaffe or Lindroth*

297, 298, 299. Composition. (AL) Weekly independent study sessions at an advanced level with a member of the graduate faculty in composition. One course each. *Jaffe or Lindroth*

INDEPENDENT STUDY

Admission to these courses will be subject to the approval of the Director of Undergraduate Studies and the instructor. The instructor and course content will be established in accordance with the individual student's interests and capacities.

179, 180. Independent Study in Musical Performance.* Open only to sophomores possessing an exceptional technical and interpretative command of a musical medium. Requires either a half-length recital at the end of each semester of study or a full-length recital at the end of the second semester. In the latter case, a brief performance before a jury of music department faculty is required at the end of the first semester. Prerequisites: previous registration in private instruction in applied music at Duke, audition, and consent of instructor. One course each. *Staff*

181, 182. Independent Study in Musical Performance.* Same as 179, 180, but for juniors. One course each. *Staff*

183, 184. Independent Study in Musical Performance.* Same as 179, 180, but for seniors. One course each. *Staff*

191, 192. Independent Study. Directed reading, research, and/or theoretical analysis, culminating in a substantial paper; or exploration of advanced compositional techniques resulting in a work of larger scale. For juniors only. One course each. *Staff*

*The schedule of fees for private lessons, as published in the subsection on fees, is applicable to courses 179, 180, 181, 182, 183, 184.

193, 194. **Independent Study.** Same as 191, 192, but for seniors. One course each.
Staff

APPLIED MUSIC

In conjunction with theory and history, performance is an active way of understanding music literature, facing questions of style, and honoring one's technical and expressive skills. Provided they qualify by audition, students are encouraged to enroll in private instruction and to participate in ensembles. Auditions must be arranged with the instructor prior to registration. Enrollment in an applied music course does not guarantee permission to enroll in the instructor's class or ensemble the following semester; in some cases another audition may be required. For those students who wish to study privately but do not qualify for university-level instruction, a list of music teachers in the immediate area who are available to Duke students can be obtained from the department office. All applied music courses may be repeated for credit, but no more than two ensembles may be taken concurrently.

57S, 58S. Vocal Diction. 57S: Italian/English; 58S: German/French. For singers, actors, radio announcers, and public speakers. Introduction to the international phonetic alphabet. Students will be required to sing in class. Written, oral, and vocal performance examinations. Half course each. *Lail*

Instruction: half hour

- 79. **Class Voice.** Quarter course. *Staff*
- 80. **Piano.** Quarter course. *Crawford, Hawkins, Love, or Szász*
- 81. **Strings.** Quarter course. *Bagg, Berg, Ku, or Raimi*
- 82. **Woodwinds.** Quarter course. *Gilmore, Jeffrey, Pederson, Troxler, or Weddle*
- 83. **Brass.** Quarter course. *Dimsdale, Eagle, or Mizesko*
- 84. **Percussion.** Quarter course. *Hanks*
- 85. **Voice.** Quarter course. *Jensen, Lail, or Tektonidis*
- 86. **Organ.** Quarter course. *Parkins*
- 87. **Harpsichord.** Quarter course. *Meniker*

Instruction: 1 hour

- 90. **Piano.** Half course. *Crawford, Hawkins, Love, or Szász*
- 91. **Strings.** Half course. *Bagg, Berg, Ku, or Raimi*
- 92. **Woodwinds.** Half course. *Gilmore, Jeffrey, Pederson, Troxler, or Weddle*
- 93. **Brass.** Half course. *Dimsdale, Eagle, or Mizesko*
- 94. **Percussion.** Half course. *Hanks*
- 95. **Voice.** Half course. *Jensen, Lail, or Tektonidis*
- 96. **Organ.** Half course. *Parkins*
- 97. **Harpsichord.** Half course. *Meniker*

Ensemble Classes: pass/fail

- 100. **Symphony Orchestra.** Quarter course. *Muti*
- 101. **Wind Symphony.** Quarter course. *Votta*
- 102. **Marching Band.** Quarter course. *Boumpani*
- 103. **Jazz Ensemble.** Quarter course. *Jeffrey*
- 106. **Chamber Music.** Quarter course. *Hawkins*
- 111. **Opera Workshop.** Quarter course. *Lail*
- 112. **Chapel Choir.** Quarter course. *Wynkoop*
- 113. **Chorale.** Quarter course. *Wynkoop*

Credit in Applied Music. (Skills courses—credit not applicable to area of knowledge requirements.) Credit for instruction in courses below 100 is granted on the basis of a half course per semester for one hour of private instruction per week and a minimum of six hours practice weekly; or a half course per year for one half hour of private instruction or one period of class study and a minimum of six hours practice per week. An additional weekly class meeting for performance and criticism may be required by the instructor without additional credit.

Fees. Applied music instruction in one medium (instrument or voice) is offered free to music majors. Additional instruction for music majors and all instruction for non-majors will be charged as follows:

One one-hour private lesson per week for one semester	\$250
One half-hour private lesson per week for one semester	\$125
One half-hour class lesson per week for one semester	\$75
Registration in ensemble classes (Music 100-113)	Free

No charge is made for practice room facilities for students registered for private or class lessons in applied music. A fee schedule for the use of facilities by others not registered for applied lessons is available from the music department office.

Fees are not refundable after the final drop/add day.

See also Institute of the Arts in this bulletin.

COURSES CURRENTLY UNSCHEDULED

77. Introduction to Chamber Music. (AL)

122. Orchestration. (AL)

135S. American Music to 1900. (AL)

139. Twentieth-Century Music. (AL)

146. Mendelssohn and Schumann. (AL)

165. Opera in Vienna. (AL)

172S. Handel and Bach: Music for Voice. (AL)

THE MAJOR

A major or second major in music is a means of preparing students for further professional training in the branches of the art, for graduate study as historians, composers, and performers, and for a more intimate understanding of one of life's most important experiences. The music major can also be an attractive pursuit for the well-rounded undergraduate planning a career in another field, such as business, law, or medicine. The aim of the required courses is to give a balanced selection of history, theory, composition, and performance, reinforced by constant attention to the art of listening. With the required courses as their foundation, students choose electives to further their interest in, or gifts for, a particular music activity, so that a performer will have a good theoretical background, a historian considerable experience as a player, a composer various kinds of understanding of music of the past, and so on.

Prerequisites. Music 65, 66, and one year of applied music study in an instrument or voice; two semesters of participation in a departmental ensemble (excluding Music 102), with or without credit.

Major Requirements. Music 116S, 117S, 123 and 124 (two half courses), 155S-158S, and one additional elective course in the department. Those who plan to study music beyond the undergraduate level are strongly advised to prepare themselves in two or more foreign languages.

Honors/Distinction. Music majors who are qualified (see the section on honors in this bulletin) may undertake work leading to departmental graduation with distinction or Latin honors by honors project. In either case the candidate must make application to the Director of Undergraduate Studies by March 20 of the junior year. The project is normally a year-long endeavor involving an independent study or an appropriate graduate seminar each semester of the senior year. It must culminate in a substantial paper (historical, analytical, or theoretical), which may be more concise if offered in conjunction with a recital or a composition. The final project must be approved by a faculty committee.

Naval Science—Navy ROTC (NS)

Professor Avery, Captain, U.S. Navy, *Chair*; Visiting Associate Professor Gore, Commander, U.S. Navy, *Director of Undergraduate Studies*; Visiting Assistant Professors Hamlin, Major, U.S. Marine Corps, Zielinski, Lieutenant, U.S. Navy, Palm, Lieutenant, U.S. Navy, and McClenney, Lieutenant, U.S. Navy

Courses in naval science are open to all students. The program in naval science offers students an opportunity to gain a broad-based knowledge in naval studies leading to a challenging career as a naval or marine corps officer. Since a major is not available in this program, scholarship program participants are encouraged to pursue majors in technical fields, although a major in any field of study leading to a baccalaureate degree meets the basic requirement. The academic program for an approved degree and commission must include all naval science courses and laboratories. Navy option scholarship students must complete one year of calculus by the end of the sophomore year, one year of calculus-based physics by the end of the junior year, one year of American military history or national security policy, one year of English, and one semester of computer science.

Nonscholarship Navy option student requirements are one year of mathematics, one year of physical science, one year of English, and one semester of computer science. Marine Corps option students are required to take one year of American military history or national security policy and, if on scholarship, one semester of a foreign language.

11. Naval Orientation. Organization, missions, and branches of specialization within the United States Navy. Customs, traditions, leadership, and career opportunities. No credit. *Zielinski*

11L. Naval Orientation Laboratory. Practical application of the elements and material presented in Naval Science 11. No credit. *Zielinski*

12. Naval Ships Systems. Quantitative study of basic naval ships' systems. Focus on propulsion and various auxiliary systems. Ship design, stability, and damage control. One course. *Zielinski*

12L. Naval Ships Systems Laboratory. Practical application of the theories and principles of naval ships systems. No credit. *Zielinski*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

52. Seapower and Maritime Affairs. The role of seapower in national and foreign policy, and as an instrument of politico-military strategy. Includes comparative study of United States and Soviet maritime strategies. One course. *McClenney*

53L. Seapower Laboratory. Case studies and contemporary issues dealing with United States Navy. Mandatory for Navy ROTC midshipmen. No credit. *McClenney*

126. Concepts and Analyses of Naval Tactical Systems. Detection systems; systems integration into current naval platforms and their offensive and defensive capabilities. One course. *Zielinski*

126L. Naval Tactical Systems Laboratory. Practical application of the theories and principles of naval tactical systems. No credit. *Zielinski*

131. Navigation. Theory, principles, and procedures of ship navigation, movements, and employment. Dead reckoning, piloting, celestial and electronic principles of navigation. Naval Science 131L should be taken concurrently. One course. *Palm*

131L. Navigation Laboratory. Practical application of the theories and principles of navigation as presented in the lecture series. No credit. *Palm*

132. Naval Operations. Components of general naval operations, including concepts and application of tactical formations and dispositions, relative motion, maneuvering board and tactical plots, rules of the road, and naval communications. Naval Science 132L is a concurrent requirement. One course. *Palm*

132L. Naval Operations Laboratory. Practical application of the theories of naval operations as presented in the lecture series. No credit. *Palm*

137L, 138L. Marine Tactics Laboratory. Concepts and applications of tactical employment of Marine Amphibious Forces. Ground weapons systems, land navigation, and small unit tactics. No credit. *Hamlin*

141S. Evolution of Warfare. Continuity and change in the history of warfare, with attention to the interrelationship of social, political, technological, and military factors. One course. *Hamlin*

145L. Naval Leadership and Management I. Study of organizational behavior and management in the context of naval organization. Topics include discussion of leadership and management functions of planning, controlling, and directing. Practical applications explored using case studies. No credit. *McClenney*

146L. Naval Leadership and Management II. The study of officer responsibilities in Naval administration. Discussions of counseling methods, military justice, human resources management, and supply systems. No credit. *Avery*

147L, 148L. Marine Leadership Laboratory. Marine Corps career management, naval correspondence, force structure, leadership techniques, and training. No credit. *Hamlin*

151S. Amphibious Operations. Development of amphibious doctrine, with attention to its current applications. One course. *Hamlin*

191. Independent Study. Directed reading and research. Open only to qualified students in junior and senior years by consent of Director of Undergraduate Studies. One course. *Staff*

Neurobiology (NBI)

For courses in Neurobiology, see Medicine (School)—Graduate (School) Basic Science Courses Open to Undergraduates

Neurosciences

For courses in neurosciences, see Biology, Psychology, and the Neurosciences Program.

Neurosciences Program

Professor W. G. Hall and Assistant Professor Nowicki, *Co-Directors*

The study of the nervous system has developed into one of the most exciting areas of modern science with rapidly expanding knowledge in both basic and medically applied areas. The Neurosciences Program offers the student guidance in planning a liberal arts education in the context of a structured emphasis on study in the neural sciences. The program especially encourages and facilitates undergraduate research participation, through independent study courses, in neuroscience laboratories across the university, including the Medical School–Graduate School Basic Sciences Department of Neurobiology. The program also sponsors special lectures, workshops, and research mini-symposia throughout the academic year designed to foster undergraduate interest in neurobiology.

Students may participate in the Neurosciences Program in one of three ways: (1) as biology majors with a neuroscience concentration in biology, (2) as psychology majors with a neuroscience concentration in psychology, or (3) as majors in other departments, by completing a sequence of required courses for a Neuroscience Program certificate. Two core courses, described below, are required for each of these options. Further, each option specifies a number of neuroscience electives, including independent study research courses, that are to be completed as part of the student's primary major. See Biology and Psychology for descriptions of neuroscience areas of concentration within these majors. Further details on the Neurosciences Program and neuroscience areas of concentration may be obtained from either of the co-directors at the program office (phone: 660-5725).

Core Courses

Psychology 103. Biological Bases of Behavior: Introduction and Survey. Physiological, developmental, and evolutionary approaches to behavior. Sensory and cognitive processes, sleep, pain, emotion, hunger, and thirst as well as maternal and sexual behavior patterns. Students required to participate as subjects in three to six hours of psychological research if not done in a previous introductory class. Prerequisite: Biology 14L, 19, 21L, or 22L; may be taken concurrently. One course. *C. Erickson or staff*

Biology 154. Principles of Neurobiology. Introduction to neuroscience, including basic physiology, microstructure, and anatomy of neural tissues; mechanisms of neuronal development and integration; sensory-motor control; the neural foundations of animal behavior, and the evolution of nervous systems. Prerequisites: Biology 21L, 22L or Biology 14L; and Chemistry 12L or equivalent. C-L: Psychology 135. One course. *Nowicki*

Elective Courses

The following is a partial listing of representative elective courses. For descriptions, consult the listings under specified departments in the undergraduate and graduate bulletins.

Developmental and Comparative Anatomy of Vertebrates. (Biology 108L.) *Staff*
 Biochemistry of Marine Animals. (Biology 1155L.) *Rittschof*
 Animal Behavior. (Biology 201L, S.) *Klopfer*
 Building the Brain. (Distinguished Professor Course 189S, Neurobiology 189S, and Psychology 189S.) *Purves*
 Marine Animal Navigation. (Biology 296.22S.) *Forward*
 Animal Communication (Biology 296.22S.) *Nowicki*
 Learning and Adaptive Behavior. (Psychology 111.) *Staddon*
 Behavior and Neurochemistry. (Psychology 126.) *Cooper*
 Fundamental Issues in the Study of the Brain. (Psychology 133.) *W. C. Hall*
 Psychobiology of Motivation. (Psychology 139.) *Staff*
 Methods in Behavioral Neurobiology. (Psychology 149S.) *W. G. Hall*
 Hormones and Behavior. (Psychology 150S.) *Izard*
 Neurobiology of Learning and Memory. (Psychology 165S.) *Swartswelder*
 Independent Study. (Biology 191, 192 and Psychology 191, 192, 193, 194.) *Staff*
 Cellular Neurobiology. (Neurobiology 208.) *Augustine, Kauer, Lo, and Reinhart*
 Systems Neurobiology. (Neurobiology 209.) *Cant and Fitzpatrick*
 Developmental Neurobiology. (Neurobiology 211.) *Katz, LaMantia, and Purves*
 Molecular Neurobiology. (Neurobiology 212.) *Matthew and Skene*

Pathology (PTH)

For courses in pathology, see Medicine (School)—Graduate (School) Basic Science Courses Open to Undergraduates.

Pharmacology

For courses in pharmacology, see Medicine (School)—Graduate (School) Basic Science Courses Open to Undergraduates.

Persian

For courses in Persian, see Asian and African Languages and Literature.

Philosophy (PHL)

Professor Brandon, *Chair*; Assistant Professor Schmaltz, *Director of Undergraduate Studies*; Professors Golding, Mahoney, and Sanford; Associate Professors Ferejohn and Posy; Assistant Professors Cooper and Lind; Professors Emeriti Peach and Welsh; Adjunct Associate Professor Ward

A major is available in this department.

The undergraduate program in the Department of Philosophy acquaints students with the content and the structure of philosophical theory in various areas. Discussion is encouraged so that students can engage actively in the philosophical examination of problems.

Course offerings fall into two general categories: the systematic and the historical. In a systematic treatment, the organization of a course is primarily in terms of the problems presented by the subject matter of that course, as in logic, ethics, and metaphysics. In historical courses, attention is directed more to the order of development in the thought of a particular philosopher (Plato, Aristotle, Kant) or in a historical period. In all courses, reading of the works of philosophers acquaints the students with the important and influential contributions to the definition and solution of philosophical issues.

The problems raised in philosophy in respect to the various fields of the arts and sciences involve questions that are not normally given attention in those particular disciplines. In the consideration of such problems, therefore, it is expected that students will acquire some understanding and perspective of the major areas of the human intellectual endeavor. In this sense, philosophical comprehension is an essential part of a student's learning and education.

Philosophy provides a sound preparation for the demands of many professions. For example, the precision of argument and broad acquaintance with intellectual traditions emphasized in philosophy form an excellent basis for the study of law. Only one course from among Philosophy 41, 42, 43S, and 44S may be taken for credit. These courses are normally not open to juniors and seniors.

41. Introduction to Philosophy. (CZ) Examination of problems in philosophy; emphasis on metaphysics and theory of knowledge. One course. *Staff*

42. Introduction to Philosophy. (CZ) Examination of problems in philosophy; emphasis on ethics and value theory. One course. *Staff*

43S. Introduction to Philosophy. (CZ) Philosophy 41 conducted as a seminar. One course. *Staff*

44S. Introduction to Philosophy. (CZ) Philosophy 42 conducted as a seminar. One course. *Staff*

48. Logic. (CZ) The conditions of effective thinking and clear communication. Examination of the basic principles of deductive reasoning. One course. *Brandon, Posy, Sanford, or staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

93. History of Ancient Philosophy. (CZ) The pre-Socratics, Socrates, Plato, Aristotle, and post-Aristotelian systems. Prerequisites: for first-year students, previous philosophy course and consent of instructor. C-L: Classical Studies 93. One course. *Ferejohn or Mahoney*

94. History of Modern Philosophy. (CZ) Bacon, Hobbes, Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, and Kant. Prerequisites: for first-year students, previous philosophy course and consent of instructor. One course. *Posy or Schmaltz*

102. Aesthetics: The Philosophy of Art. (CZ) The concept of beauty, the work of art, the function of art, art and society, the analysis of a work of art, criticism in the arts. One course. *Ward*

103. Symbolic Logic. (CZ) Detailed analysis of deduction and of deductive systems. Open to sophomores by consent of instructor. C-L: Linguistics. One course. *Brandon or Posy*

104. Philosophy of Science. (CZ) The principal philosophical and methodological problems in contemporary science. One course. *Brandon or Cooper*

106. Philosophy of Law. (CZ) Natural law theory, legal positivism, legal realism, the relation of law and morality. One course. *Golding*

107. Political and Social Philosophy. (CZ) The fundamental principles of political and social organizations. One course. *Mahoney*

109. Philosophy of Language. (CZ) A philosophical analysis of problems arising in the study of language and symbolism. Topics include: theories of language, the nature of signs and symbols, theories of meaning, types of discourse (scientific, mathematical, poetic), definition, ambiguity, metaphor. C-L: Linguistics. One course. *Posy*

110. Knowledge and Certainty. (CZ) Problems in the theory of knowledge: conditions of knowledge, scepticism, perception, memory, induction, knowledge of other minds, and knowledge of necessary truths. One course. *Ferejohn or Sanford*

111. Appearance and Reality. (CZ) Problems in metaphysics: theories of existence, substance, universals, identity, space, time, causality, determinism and action, and the relation of mind and body. One course. *Ferejohn or Sanford*

112. Philosophy of Mind. (CZ) Such topics as mind and body, thought, perception, persons, and personal identity. One course. *Sanford*

113. Philosophy of Mathematics. (CZ) Survey of mathematical thought including the nature of infinity, Platonism, constructivism, and the foundational crisis of the early twentieth century. Prerequisite: one course in calculus or logic or philosophy; or consent of instructor. One course. *Posy*

115. Environmental Ethics. (CZ) Critical investigation of the goals of environmental policy and the values to which these goals give expression. Various "land health" issues such as biodiversity, ecosystem preservation, ecological restoration, agricultural practice, and pollution. One course. *Cooper*

116. Systematic Ethics. (CZ) Problems in moral philosophy: the nature of morality, ethical relativism, egoism, utilitarianism. Both historical and contemporary readings, with emphasis on the latter. One course. *Golding or Lind*

117. Ancient and Modern Ethical Theories. (CZ) The development of ethical thought in the West; the interaction between culture and ethical theory, with special reference to the Greek city-state, Roman law, the Renaissance, the Reformation, and the rise of modern science. Readings in the great ethical philosophers. One course. *Golding or Lind*

119. Medieval Philosophy. (CZ) Christian, Islamic, and Jewish philosophy from late antiquity to 1300. Special emphasis on historical influences and institutional developments. Nature and destiny of humans, existence and nature of God, problem of ethical

norms, political philosophy. C-L: Medieval and Renaissance Studies. One course. *Mahoney*

120. Late Medieval and Renaissance Philosophy. (CZ) Problems of political authority and nature of the state, mysticism, humanism, critical trends, background of Galileo, and impact of the Reformation related to cultural and institutional changes. C-L: Medieval and Renaissance Studies. One course. *Mahoney*

122. Philosophical Issues in Feminism. (CZ) Issues in political and moral philosophy in their bearing on feminist concerns, including political equality and rights, preferential treatment, feminist and non-feminist critiques of pornography, and the morality of abortion. C-L: Women's Studies. One course. *Lind*

123. Aristotle. (CZ) Survey of principal topics in Aristotelian philosophy. Areas of study include metaphysics, epistemology, philosophy of science, philosophy of language, ethics, and political philosophy. C-L: Classical Studies 113. One course. *Ferejohn*

124. Philosophy of Education. (CZ) Alternative models of the educational process and of the relationship between education and moral development. The ideal of the "educated individual": education vs. training. The ideal of liberal learning: its moral context and its presuppositions. The educational process and its institutional settings. Readings from Plato, Aristotle, Aquinas, Rousseau, Kant, Whitehead, and others. One course. *Ward*

125. Philosophy of Music. (CZ) The nature of music and its place in the arts. Emotion and meaning, creation and interpretation in music. Readings from a wide variety of sources. One course. *Ward*

132. Nineteenth-Century Philosophy. (CZ) Emphasis on Hegel, Marx, and Nietzsche. One course. *Staff*

134. Existentialism. (CZ) Themes and approaches in existential philosophy. Selected writings of Kierkegaard, Tolstoy, Dostoevsky, Heidegger, and Sartre. Contemporary relevance of existentialist perspectives. One course. *Ward*

135. Philosophy in Literature. (CZ) Comparative examination of philosophical topics such as freedom, responsibility, good and evil, time and reality. One course. *Staff*

139. Twentieth-Century Continental Philosophy. (CZ) A critical and historical examination of movements in European philosophy such as existentialism, structuralism, poststructuralism, hermeneutics, and critical theory. Husserl, Heidegger, Sartre, Gadamer, Habermas, and Derrida: their views of language, history, and the problems of modern society. One course. *Staff*

173. Classical Political Philosophy. (CZ) Prerequisite: junior standing; open to sophomores by consent of instructor. See C-L: Classical Studies 173; also C-L: Political Science 182. One course. *Staff*

191, 192, 193, 194. Independent Study. Directed reading and research. Open only to highly qualified students in the junior and senior year with consent of the department. One course each. *Staff*

For Seniors and Graduates

203S. Contemporary Ethical Theories. (CZ) The nature and justification of basic ethical concepts in the light of the chief ethical theories of twentieth-century British and American philosophers. One course. *Golding or Lind*

204S. Philosophy of Law. (CZ) Natural law theory and positivism; the idea of obligation (legal, political, social, moral); and the relation of law and morality. One course. *Golding*

206S. Responsibility. (CZ) The relationship between responsibility in the law and moral blameworthiness; excuses and defenses; the roles of such concepts as act, intention, motive, ignorance, and causation. One course. *Golding*

208S. Political Values. (CZ) Analysis of the systematic justification of political principles and the political values in the administration of law. One course. *Golding*

210. Logic for Computer Science. (QR) See C-L: Computer Science 218. One course. *Loveland or Nadathur*

211S. Plato. (CZ) Selected dialogues. C-L: Classical Studies 211S. One course. *Ferejohn*

217S. Aristotle. (CZ) Selected topics. C-L: Classical Studies 217S. One course. *Ferejohn*

218S. Medieval Philosophy. (CZ) Selected problems. C-L: Medieval and Renaissance Studies. One course. *Mahoney*

219S. Late Medieval and Renaissance Philosophy. (CZ) Selected problems. C-L: Medieval and Renaissance Studies. One course. *Mahoney*

225S. British Empiricism. (CZ) A critical study of the writings of Locke, Berkeley, or Hume with special emphasis on problems in the theory of knowledge. One course. *Lind or Schmaltz*

227S. Continental Rationalism. (CZ) A critical study of the writings of Descartes, Spinoza, or Leibniz with special emphasis on problems in the theory of knowledge and metaphysics. One course. *Schmaltz*

228S. Recent and Contemporary Philosophy. (CZ) A critical study of some contemporary movements, with special emphasis on analytic philosophers. C-L: Linguistics. One course. *Posy*

231S. Kant's *Critique of Pure Reason*. (CZ) One course. *Posy*

232S. Recent Continental Philosophy. Selected topics. One course. *Staff*

233S. Methodology of the Empirical Sciences. (CZ) Recent philosophical discussion of the concept of a scientific explanation, the nature of laws, theory and observation, probability and induction, and other topics. Consent of instructor required. One course. *Brandon*

234S. Problems in the Philosophy of Biology. (NS) Selected topics, with emphasis on evolutionary biology: the structure of evolutionary theory, adaptation, teleological or teleonomic explanations in biology, reductionism and organicism, the units of selection, and sociobiology. Consent of instructor required. C-L: Biology 234S. One course. *Brandon*

235S. Nineteenth-Century German Philosophy. (CZ) A critical examination of the writings of Hegel, Marx, or Nietzsche. One course. *Staff*

250S. Topics in Formal Philosophy. (CZ) Topics selected from formal logic, philosophy of mathematics, philosophy of logic, or philosophy of language. C-L: Linguistics. One course. *Posy*

251S. Epistemology. (CZ) Selected topics in the theory of knowledge; for example, conditions of knowledge, scepticism and certainty, perception, memory, knowledge of other minds, and knowledge of necessary truths. One course. *Sanford*

252S. Metaphysics. (CZ) Selected topics: substance, qualities and universals, identity, space, time, causation, and determinism. One course. *Sanford*

253S. Philosophy of Mind. (CZ) Analysis of concepts such as thought and belief; issues such as mind-body relations, thought and action, the nature of persons and personal identity. One course. *Sanford*

289S. Environmental Ethics. (CZ) Selected topics involving values and the environment, for example, extending morality to nature, rights of future generations, environmental aesthetics, diversity and stability, ideological biases in ecological knowledge. Consent of instructor required. C-L: Environment 282S. One course. *Cooper*

291S, 292S. Special Fields of Philosophy. One course each. *Staff*

COURSES CURRENTLY UNSCHEDULED

101. Philosophy of Religion. (CZ)

105. Philosophy of History. (CZ)

108. Social Ideals and Utopias. (CZ)

114D. Hellenistic Philosophy. (CZ)

118. Philosophical Issues in Medical Ethics. (CZ)

121. Philosophy and Film. (CZ)

138. Analytic Philosophy in the Twentieth Century. (CZ)

196S, 197S, 198S, 199S. Seminars in Philosophy

202S. Aesthetics: The Philosophy of Art. (CZ)

205S. Philosophy of History. (CZ)

230S. The Meaning of Religious Language. (CZ)

254S. Topics in Philosophy of Religion. (CZ)

THE MAJOR

Major Requirements. Eight courses in philosophy including Philosophy 93 and 94; at least one nonintroductory course in moral, social, political, or legal philosophy, such as Philosophy 106, 107, 108, 116, 117, 118, or 122; and at least one course at the 200 level. In addition, a course in logic is highly recommended.

Honors/Distinction. The department offers work leading to graduation with distinction. See the section on honors in this bulletin.

Physics (PHY)

Professor Evans, *Chair*; Professor Walter, *Director of Undergraduate Studies*; Professors Behringer, Bilpuch, Fortney, Goshaw, Han, Johnson, Madey, Meyer, Müller, Palmer, Roberson, Robinson, Thomas, Walker, and Weller; Associate Professors Greenside, Howell, and Oh; Assistant Professors Gauthier, Lee, Socolar, Springer, and Teitsworth; Research Associate Professors Litvinenko and Tornow; Research Assistant Professor Phillips; Adjunct Professors Guenther, Iafrate, Rogosa, and Stroschio; Adjunct Associate Professors Lawson and Skatrud; Adjunct Assistant Professors Everitt and Kolena; Visiting Assistant Professor Brown; Lecturer Haque

A major is available in this department.

Through the study of physics students learn the methods and results of a systematic examination of the objects that make up the natural universe and of their interactions with each other. The knowledge and analytical skills thus obtained are basic to the study of the sciences and engineering. The department offers a number of courses for nonspecialists who wish to learn about the physicist's description of nature for its intrinsic intellectual value.

21, 22. Introductory Physics. Credit for advanced placement on the basis of the College Board Examinations "Physics-C." One course each.

32. Physics from the Historical Perspective. (NS) The historical development of physical theories is traced from early theories of the solar system to relativity and quantum theory. No previous study of physics is assumed, but the student must be able to use simple mathematics through basic algebra. One course. *Staff*

35. Practical Physics. (NS) Fundamental concepts and laws of physics in the context of technological applications. Intended for persons not majoring in science or engineering; no previous knowledge of physics is assumed. The emphasis is on "how things work." One course. *Robinson*

36. Acoustics and Music. (NS) The physical principles underlying musical instruments, room acoustics, and the human ear. Analysis, reproduction, and synthesis of musical sounds. No previous knowledge of physics is assumed. C-L: Music 36. One course. *Lawson*

41L, 42L. Fundamentals of Physics. (NS) For students interested in majoring in physics; taken in the freshman year. Basic principles of physics, mainly classical, at a level similar to Physics 51L, 52L, but with emphasis on laying a foundation for further study. Lecture, recitations, and laboratory. Closed to students having credit for Physics 51L, 52L. Prerequisites: consent of Director of Undergraduate Studies; Mathematics 31 and 32 may be taken concurrently. One course each. *Evans or Roberson*

51L, 52L. Introductory Technical Physics. (NS) A survey of the principles of classical physics, intended principally for students in the physical sciences and engineering. Students planning a major in physics should enroll instead in Physics 41L, 42L in their freshman year. Physics 51L is closed to students having credit for Physics 41L or Physics 53L; Physics 52L is closed to students having credit for Physics 42L or Physics 54L. Prerequisite: Mathematics 31, 32 or equivalent; Mathematics 32 may be taken concurrently with Physics 51L; for 52L: Physics 51L or 53L. One course each. *Staff*

53L, 54L. General Physics. (NS) A survey of the principles of physics, intended mainly for students planning study in medicine or the life sciences. The level and coverage are similar to that of Physics 51L, 52L, but there are differences in emphasis. Physics 53L is closed to students having credit for Physics 41L or Physics 51L; Physics 54L is closed to students having credit for Physics 42L or Physics 52L. Prerequisite: Mathematics 31, 32 or equivalent; Mathematics 32 may be taken concurrently with Physics 53L; for 54L: Physics 51L or 53L. One course each. *Behringer and Howell*

55. Introduction to Astronomy. (NS) The evolving theory of the physical universe. Cosmological models, galaxies, stars, interstellar matter, the solar system, and experimental techniques and results. Several observatory sessions. One course. *Everitt*

100. Introduction to Modern Physics. (NS) Survey of modern physics including relativity and the quantum physics of atoms, nuclei, particles, and quarks. Not applicable toward a major in physics. Prerequisites: Physics 51L, 52L or 41L, 42L and Mathematics 103 (may be taken concurrently). One course. *Han*

105. Introduction to Astrophysics. (NS) Basic principles of astronomy treated quantitatively. Cosmological models, galaxies, stars, interstellar matter, the solar system, and experimental techniques and results. Prerequisites: Mathematics 31 and Physics 51L, 52L or consent of the instructor. One course. *Kolena*

143L. Optics and Modern Physics. (NS) Intended as a continuation of Physics 41L, 42L. Classical wave and ray optics. Introduction to quantum physics. Prerequisites: Physics 41L, 42L or 51L, 52L and Mathematics 103 (may be taken concurrently). One course. *Walter*

Physics 41L, 42L or 51L, 52L or equivalents, and Mathematics 103 or equivalent are prerequisites to all of the following courses.

171L. Electronics. (NS) Elements of electronics including circuits, transfer functions, solid-state devices, transistor circuits, operational amplifier applications, digital circuits, and computer interfaces. Lectures and laboratory. One course. *Fortney*

176. Thermal Physics. (NS) Thermal properties of matter treated using the basic concepts of entropy, temperature, chemical potential, partition function and free energy. Topics include the laws of thermodynamics, ideal gases, thermal radiation and electrical noise, heat engines, Fermi-Dirac and Bose-Einstein distributions, semiconductor statistics, kinetic theory, and phase transformations. Prerequisites: Physics 51L, 52L or equivalent and Mathematics 103 or equivalent. C-L: Electrical Engineering 176. One course. *McCumber or Teitsworth*

181. Introductory Mechanics. (NS) Newtonian mechanics at the intermediate level, Lagrangian mechanics, linear oscillations, special relativity. Prerequisite: Mathematics 111 or equivalent (may be taken concurrently). One course. *Gauthier*

182. Electricity and Magnetism. (NS) Electrostatic fields and potentials, boundary value problems, magnetic induction, energy in electromagnetic fields, Maxwell's equations, introduction to electromagnetic radiation. Prerequisite: Mathematics 111 or equivalent. One course. *Evans*

185, 186. Modern Optics. (NS) Optical processes including the propagation of light, coherence, interference, and diffraction. Consideration of the optical properties of solids with applications to modern optical devices. Second semester will emphasize nonlinear interactions, optical modulators, lasers, and spectroscopy. Lecture and laboratory projects. One course each. *Guenther*

191, 192. Independent Study. Consent of instructor required. One course each. *Staff*

For Seniors and Graduates

211. Modern Physics. (NS) Fundamental concepts of quantum theory applied mainly to study of atomic structure and spectra, and to statistical physics. Prerequisites: Physics 181 and Mathematics 111. One course. *Staff*

213. Nonlinear Dynamics. (QR) Prerequisites: Computer Science 53, Mathematics 111, and Physics 51L, 52L. See C-L: Computer Science 213. One course. *Behringer*

214. Introduction to Solid-State Physics. (NS) Discussion of solid-state phenomena including crystalline structures, X-ray and particle diffraction in crystals, lattice dynamics, free electron theory of metals, energy bands, and superconductivity, with emphasis on understanding electrical and optical properties of solids. Prerequisite: quantum physics at the level of Physics 143L or Electrical Engineering 211. C-L: Electrical Engineering 214. One course. *Teitsworth*

215. Introduction to Quantum Mechanics. (NS) Fundamental postulates; wave mechanics and elementary applications; operators, eigenvalues, and eigenfunctions;

angular momentum and rotations; spin and coupling of angular momenta; perturbation theory, transition rates, and selection rules; identical particles; applications. Prerequisites: Physics 181 and 211; Mathematics 111 and 114 (may be taken concurrently). One course. *Müller*

217S, 218S. Advanced Physics Laboratory and Seminar. (NS) Experiments involving the fields of electricity, magnetism, heat, optics, and modern physics. One course each. *Meyer*

225, 226. Elementary Investigations. (NS) Training in the laboratory and library methods of physical research. Qualified students may conduct elementary investigations under the supervision of a member of the staff. One course each. *Staff*

230. Mathematical Methods in the Physical Sciences I. (QR) Mathematical methods chosen to aid in the understanding of physical science, including topics in integration, probability, series, complex analysis, fourier analysis, vector calculus, curvilinear coordinates, matrices, differential equations, and special functions. Includes use of Mathematica for graphical, symbolic, and numerical computation. One course. *Palmer*

231. Mathematical Methods in the Physical Sciences II. (QR) Mathematical methods chosen to aid in the understanding of physical science, including topics in differential equations, Legendre functions, spherical harmonics, Bessel functions, Green's functions, integral equations, tensors, group theory, Laplace transforms, calculus of variations, and statistics. Includes use of Mathematica for graphical, symbolic, and numerical computation. Prerequisite: Physics 230 or consent of instructor. One course. *Palmer*

244. Nuclear and Particle Physics. (NS) Current ideas and models in nuclear and particle physics. Experimental methods; nuclear structure; nuclear reactions; families of elementary particles; quarks and gluons; weak interactions. Prerequisite: Physics 211. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

102. Applications of Modern Physics in Medicine. (NS)

106. Topics in Astrophysics. (NS)

240. Computer Applications to Physical Measurement. (NS)

THE MAJOR

Students majoring in physics are prepared for work in industrial and governmental laboratories. They are also prepared for graduate work in physics or for the study of medicine. Students planning to major in physics should enroll in Physics 41L, 42L in their freshman year. They should also arrange to complete the necessary mathematics as soon as possible.

For the A.B. Degree

Prerequisites. Physics 41L, 42L or 51L, 52L, or equivalents; Mathematics 31, 32, 103, 111, or equivalents, and one additional course at the 100 or 200 level.

Major Requirements. Physics 143L, 171L, 176, 181, and two other courses in physics above 100 other than Physics 230 and 231.

For the B.S. Degree

Prerequisites. Physics 41L, 42L or 51L, 52L, or equivalents; Mathematics 31, 32, 103, 111, or equivalents, and one additional course at the 100 or 200 level.

Major Requirements. Physics 143L, 171L, 176, 181, 182, 211, and two other courses in physics above 100 (except for Physics 230 and 231), at least one of which must be a laboratory course. Students planning graduate study in physics are urged to take one additional elective in physics and one in mathematics. (For the major, Physics 230 and 231 are considered mathematics courses).

Honors/Distinction

The department offers upperclassmen the possibility of being associated with research conducted in the department. This work may lead to graduation with distinction. See the section on honors in this bulletin.

Polish

For courses in Polish, see Slavic Languages and Literatures.

Political Science (PS)

Professor Aldrich, *Chair*; Professor Holsti, *Director of Undergraduate Studies*; Professors Ascher, Barber, Bates, Fish, Horowitz, Hough, Kornberg, Lange, Paletz, Price, and Spragens; Associate Professors Eldridge, Gillespie, Grieco, Johns, Kitschelt, and McKean; Assistant Professors Archer, Bianco, Brehm, Coles, Feaver, Grant, Gronke, Hamilton, Lomperis, Niou, Roberts, Simmons, and Smith; Professors Emeriti Ball, Braibanti, Cleaveland, Grzybowski, Hall, and Leach; Adjunct Professor O'Barr

A major is available in this department.

Courses in political science for undergraduates are offered in four fields: (A) American government, politics, and public administration; (B) comparative government and politics; (C-N) normative political theory/ (C-E) empirical political theory and methodology; and (D) international law, relations, and politics. In the course descriptions below the field within which the course falls is indicated by the appropriate letter symbol (A, B, C-N/C-E, or D) after the course title. (The area of knowledge designation follows.) Courses numbered from 91 through 94 serve as an introduction both to the study of political science and to the subject matter and approaches of the relevant field. Middle and upper-level courses and seminars (numbered at the 100 and 200 levels respectively) consider particular aspects and topics within the field. In addition, independent study under faculty supervision enables students to explore topics of special interest. See below, following the course descriptions, for the listing of courses by fields, information on internships, and requirements for the major and honors.

INTRODUCTORY COURSES

The following courses introduce the study of political science. Courses numbered 91 through 94 each serve as the basic course in one of the four fields of the discipline. Students ordinarily will take at least one of these courses before proceeding to more advanced courses. Some advanced courses may require a particular introductory course as a prerequisite.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

90A. American Government and Politics (A). Credit for advanced placement on the basis of the College Board examination in American Government and Politics. Does not satisfy course requirements of the political science major. One course.

90B. Comparative Government and Politics (B). Credit for advanced placement on the basis of the College Board examination in Comparative Government and Politics. Does not satisfy course requirements of the political science major. One course.

91. The American Political System (A). (SS) Theory and practice of American government and politics; federal-state relations; the separation and interrelationships of the executive, legislative, and judicial branches of government; judicial review; the role of political parties and public opinion; the formulation and execution of domestic and foreign policy; civil liberties. One course. *Staff*

91D. The American Political System (A). (SS) Same as Political Science 91 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Bianco or Kornberg*

92. Comparative Politics (B). (SS) Topics include problems of conceptualization and analysis; foundations of politics under democratic, authoritarian, and totalitarian regimes; theories of development and underdevelopment; revolution and collective violence; the role of elites, such as the military. C-L: Comparative Area Studies. One course. *Staff*

92D. Comparative Politics (B). (SS) Same as Political Science 92 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Archer*

93. Elements of International Relations (D). (SS) The nature of international politics, the analysis of national power, the instruments of foreign policy, and the controls of state behavior. One course. *Staff*

93D. Elements of International Relations (D). (SS) Same as Political Science 93 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Eldridge, Feaver, or Lomperis*

94. Contemporary Political Ideologies (C-N). (SS) Liberalism, conservatism, socialism, fascism, and feminism. One course. *Staff*

94D. Contemporary Political Ideologies (C-N). (SS) Same as Political Science 94 except instruction is provided in two lectures and one small discussion meeting each week. One course. *Staff*

98. Introduction to Canada. (SS) See C-L: Interdisciplinary Course 98; also C-L: Canadian Studies, Economics 98, History 98, and Sociology 98. One course. *Cahow or Thompson*

COURSES TAUGHT IN DUKE STUDY ABROAD PROGRAMS

100, A-M. Duke University Overseas Program. (SS) This number represents course credit for political science courses taken in Duke University Summer Session Study Abroad Programs or in Duke University semester or academic year programs with overseas universities. Register for program by designated suffix A through M. C-L: Comparative Area Studies. Variable credit.

100A. Duke Semester/Academic Year Program: Berlin. (FL, SS)

.01 Environmental Policy in Europe (B) (SS). Not open to students who have taken Political Science 162. One course.

.02 Germany: From Division to Unification (D) (FL,SS). Taught in German. Not open to students who have taken Political Science 134. One course.

C-L: Comparative Area Studies. Variable credit.

100B. Duke Summer Program: Brazil. (SS)

.01 Authoritarianism and Democracy in Brazil (B). One course.

.02 Brazil in World Politics (D). One course.

C-L: Comparative Area Studies. Variable credit.

100C. Duke Summer Program: Zimbabwe/Botswana. (SS)

.01 Politics and Literature in Southern Africa (B). One course.

.02 Issues of Development and Dependence in Botswana and Zimbabwe (D). One course.

C-L: African and Afro-American Studies 100 and Comparative Area Studies. Variable credit.

100E. Duke Summer Program: London. (SS) .01 Media and Politics in Britain (B).

C-L: Comparative Area Studies. Two courses.

100F. Duke Summer Program: Israel. (SS) .01 Israel from Utopia to History (B). C-L:

Comparative Area Studies. One course.

100G. Duke Summer Program: Mexico. (SS) .01 United States-Latin American

Relations (D). C-L: Comparative Area Studies. One course.

100H. Duke Semester Program: Bologna. (SS) .01 Italian Politics from the Risorgi-

mento to the Present (B). C-L: Comparative Area Studies. One course.

100J. Duke Wind Symphony Semester Program: Vienna. (SS) .01 Government and

Politics of Austria in Europe (B). C-L: Comparative Area Studies. One course.

100K. Duke Summer Program: Cambridge (England). (SS)

.01 Anglo-American Constitutionalism, Law, and Legal Institutions (A). Not open to students who have taken Political Science 100D.01. One course.

.02 British Government and Constitutional Law (B). Not open to students who have taken Political Science 100D.02. One course.

C-L: Comparative Area Studies. Variable credit.

100L. Duke Summer Program: Oxford. (SS)

.01 Political System of Modern Britain (B). Not open to students who have taken Political Science 199B: Oxford. Two courses.

.02 Law and Liability: Personal Injury in Britain and the United States (B). Not open to students who have taken Political Science 199B: Oxford. Two courses.

C-L: Comparative Area Studies. Variable credit.

100M. Duke Summer Program: Spain. (SS) .01 Government and Politics of Spain

(B). Not open to students who have taken Political Science 117: Comparative Government and Politics: Spain. C-L: Comparative Area Studies. One course.

OTHER UNDERGRADUATE COURSES

101A, S. Issues in Twentieth-Century American Political Practice (A). (SS) Semi-

nar on the nature of American government. Selected contemporary problems and institutions. Open only to students in the Twentieth-Century America (FOCUS) Program. One course. *Staff*

101B, S. Issues in Twentieth-Century Political Development (B). (SS) Seminar on

agrarian origins of human societies and transitions to industrial societies with attendant economic growth, political conflict, and revolution. Politics of development examined; experiences of modern Africa, Soviet Union, and Viet Nam considered and compared to lessons supplied by Medieval Europe. Open only to students in the FOCUS Program Contemporary Global Culture. One course. *Staff*

101C, S. Issues in Twentieth-Century American Political Theory (C-N). (SS)

Seminar on contemporary issues of American political thought. Attempts to refurbish or develop alternatives to the dominant liberal tradition. Open only to students in the Twentieth-Century America (FOCUS) Program. One course. *Staff*

102. Comparative Analysis of Democratic Institutions (B). (SS) The selection and consequences of democratic political institutions with special emphasis on electoral systems and constitutions. One course. *Niou*

103. Introduction to Urban Politics (A). (SS) Theory and practice of American city politics: relationships between governmental structures and historical development; distribution of power; constituency demands. One course. *Staff*

104. Politics and Literature (C-N). (SS) The enduring questions of politics and political philosophy illustrated in Western literature: historical, literary, and philosophical analysis. One course. *Gillespie or Grant*

105. The Politics of Democratization in Eastern Europe (B). (SS) Overview of political regimes in selected East European countries, comparative analysis of modes of transition to democracy: constitutionalism, party systems and voting, private property rights and economic regulation under socialism and capitalism. One course. *Kitschelt*

106. International Security (D). (SS) International conflict in modern times. Causes and effects of war. Contemporary and future threats. One course. *Fearer*

107. Comparative Environmental Policies (B). (SS) Comparative analysis of environmental problems and policies in politically diverse industrialized nations including the United States, Russia, and Japan. C-L: Comparative Area Studies and Public Policy Studies 107. One course. *McKean*

108. The American Presidency (A). (SS) The presidency and its impact on the American political system. One course. *Paletz*

109. State and Local Government Today (A). (SS) Problems in state, county, and city government. One course. *Staff*

110. American Political Parties (A). (SS) Introduction to party systems with application to the United States, including parties in the electorate, parties as organizations, and parties in government. One course. *Gronke*

111. Contemporary Japanese Politics (B). (SS) Introduction to political change in postwar Japan. Foundations of the modern industrial state, electoral politics, policy-making and bureaucracy, defense, foreign policy, and foreign trade. C-L: Comparative Area Studies. One course. *McKean*

113. International Political Economy (D). (SS) The interplay between politics and economics in international trade, money, investment, and technology flows among advanced capitalist societies, between developed and developing countries, and between capitalist and socialist countries. One course. *Grieco*

114. Public Opinion (A). (SS) Public attitudes toward political problems; special attention paid to the origins, manifestations, and consequences of public opinion in American politics. One course. *Brehm or Gronke*

115. Politics and Society in Germany (B). (SS) Industrialization, democratization, and fascism in Germany; social structure, political institutions, and political culture; selected public policies; Germany in the world economy and in world politics. C-L: Comparative Area Studies. One course. *Kitschelt*

117. Comparative Government and Politics: Selected Countries (B). (SS) Special topics course treating the political system of one or more countries from a comparative perspective. One course. *Staff*

118. American Constitutional Development (A). (SS) Development of the United States Constitution through Supreme Court decisions, 1790 to the present. One course. *Fish*

119. Martin Luther King, Jr. and the Problem of Peace (D). (SS) The philosophical and theoretical work of Martin Luther King, Jr. on the problem of peace in international relations; philosophical and analytical treatises on his work; and the significance of Dr. King for international peace in comparative perspective. C-L: African and Afro-American Studies 119. One course. *Roberts*

120. International Conflict and Violence (D). (SS) Nature and processes of international conflict and violence with emphasis on contemporary instances of violence in international affairs. Consideration of restraints on violence. One course. *Eldridge*

121. International Organization (D). (SS) Political aspects of military and economic organizations at the global and regional levels of the international system. One course. *Grieco*

122. Modern International Politics (D). (SS) The major problems in contemporary international affairs with attention to superpower politics, specific regional concerns, and the problems associated with the emergence of a new international economic order. One course. *Eldridge or Lomperis*

123. Introduction to Political Philosophy (C-N). (SS) The nature and enduring problems of political philosophy, illustrated by selected theorists in the Western political tradition. One course. *Staff*

124. National Economic Statecraft (D). (SS) Identification and analysis of major sources of foreign policy, range of state political-economic goals in the international system, and policy instruments available to state pursuit of such goals. One course. *Grieco*

125. Strategies of Comparative Analysis (B). (SS) See C-L: Comparative Area Studies 125; also C-L: Cultural Anthropology 125, History 137, Religion 121, and Sociology 125. One course. *Staff*

126. Theories of Liberal Democracy (C-N). (SS) Critical discussion of classic theorists, such as Locke, Rousseau, Mill, and Madison, and contemporary theories of liberal democracy. One course. *Grant or Spragens*

127. Law and Politics (A). (SS) Nature and functions of law; Anglo-American legal institutions; the process of judicial decision making; and the relationships among judges, lawyers, legislators, and administrators in the development of public as well as private law. One course. *Fish*

128. Politics of the Executive Branch (A). (SS) Policy-making in the executive branch of government: office of the President, cabinet, and independent agencies. Emphasis on relations with Congress and the courts. One course. *Staff*

129. Political Participation (A). (SS) The motives, methods, and results of the activities of individuals and groups and of social movements. C-L: Women's Studies. One course. *Paletz*

130S. Democracy and Community in the Welfare State (A). (SS) See C-L: Public Policy Studies 130S. One course. *Smith*

131. Introduction to American Political Thought (C-N). (SS) Basic elements in the American political tradition as developed from its English roots to the present. One course. *Grant or Spragens*

132. Politics of Asia (B). (SS) The impact of nationalism, development, and revolution on traditional Asian society and its emerging states. C-L: Comparative Area Studies. One course. *Lomperis*

133. Japanese Foreign Relations (D). (SS) Japan's increasing world role; emphasis on economic foreign policy and United States-Japanese relations. C-L: Comparative Area Studies. One course. *McKean*

135. Political Development of Western Europe (B). (SS) The development of the modern political systems of Britain, France, Germany, and other European countries; the spread of capitalism, the emergence of mass democracy and the rise of the welfare state. Contemporary developments examined in historical and theoretical perspective. C-L: Comparative Area Studies. One course. *Kitschelt or Lange*

136. Comparative Government and Politics: Western Europe (B). (SS) Modern political institutions and processes of European democracies: political parties, interest groups and parliaments; regional, religious, and class divisions; political participation and mobilization; relationships of state, society and economy; political, social and economic change in postwar Europe. C-L: Comparative Area Studies. One course. *Kitschelt or Lange*

137. Campaigns and Elections (A). (SS) An introduction to voting and elections in the United States, with emphasis on presidential nomination and election procedures, characteristics of the American electorate, and theories of voting behavior in presidential and congressional elections. One course. *Aldrich, Brehm, or Gronke*

138. Quantitative Political Analysis I (C-E). (QR) Basic applications of statistical methods to the analysis of political phenomena. Emphasis on research design, graphical display, probability, testing of hypotheses, statistical inference, and the use of computers. One course. *Brehm*

139. Conflict, Collusion, and Cooperation (C-E). (SS) How actors in the political process manipulate information, institutions, and strategies to produce preferred outcomes. Applications to elections, legislative behavior, international conflict, and other areas. One course. *Bianco or Niou*

140. Feminist Theory (C-N). (SS) Exploration of contemporary American feminist thought challenging traditional forms of power and the relationship between public and private reason and unreason. Included are works by liberal, radical, lesbian, and socialist feminists as well as works which address issues of concern specific to women of color. One course. *Staff*

142. War and Peace (D). (SS) The use of systems theory in comparative political history to explain why some international systems during particular periods have been plagued by war while others have been relatively peaceful. Special attention given to the Bismarckian system. One course. *Roberts*

143. Politics of Liberties (A). (SS) Theory and development of the Bill of Rights through Supreme Court decisions. One course. *Fish*

144. Force and Statecraft (D). (SS) Theory and practice of the use of force as an instrument of state policy in international relations. Prerequisite: Political Science 93 or equivalent. One course. *Feaver*

145. Political Analysis for Public Policy-Making (A). (SS) Prerequisite: Political Science 90A, 91, 101, or equivalent. See C-L: Public Policy Studies 114. One course. *Ascher, Hamilton, Mayer, Miller, or Smith*

146. American Legislative Behavior (A). (SS) An introduction to the American legislative process, with specific focus on the U.S. Congress. Emphasis on legislative

rules and procedures, congressional elections, and the behavior of legislators in their representative and policy-making roles. One course. *Bianco or Gronke*

147. International Environmental Politics and Policies (D). (SS) Environmental issues in developing countries in the context of the North-South problem; transboundary pollution problems and international trade; problems of the global commons (such as the deep sea, the upper atmosphere, genetic resources); international organizations and environmental policy. C-L: Comparative Area Studies and Public Policy Studies 147. One course. *McKean or Miranda*

149. United States and East Asia (D). (SS) American military intervention in China, Korea, and Vietnam; contemporary United States relations with Japan, China, and other Asian nations; new trends and sources of tension in East Asia and the Pacific. C-L: Comparative Area Studies. One course. *Staff*

150. The Individual and Society: The Classical View (C-N). (SS) Ancient political philosophy and drama emphasizing the case of Socrates. Readings include Plato's *Republic*, *Apology*, and *Crito*; Aristophanes' *The Clouds*; Sophocles' *Antigone*. One course. *Grant*

151. Introduction to Latin American Politics (B). (SS) Historical and cultural context of political institutions and behavior; the role of traditional and emerging groups and forces, political instability and the decision-making process. C-L: Comparative Area Studies and History 144. One course. *Archer*

152. Political Mobilization of the American Public (A). (SS) Interest group representation of individual citizens before national policy-making forums. Interest group formation, persistence, functions, and consequences. One course. *Gronke*

153, 154. Politics and the Media of Mass Communication 153 (B), 154 (A). (SS) Analysis of the nature, organization, and products of the mass media (especially the movie, television, and newspaper industries) as they affect the political systems, political processes, institutions, and people of the United States and other nations. Open to juniors and seniors. It is desirable but not required that students taking 153 continue with 154. With consent of the instructor, students who have not taken 153 may enroll in 154. C-L: Comparative Area Studies; Film and Video; and Women's Studies. One course each. *Paletz*

155. The Politics and Economics of Developing Areas (B). (SS) Process and politics of transition of rural and agrarian societies to urban and industrial societies: Soviet Union, United States, India, Africa, and Asia. C-L: Comparative Area Studies. One course. *Bates*

156. Space, Weapons, and War (D). (SS) Space, weapons, and war in international relations. Offense, defense, and space technology. One course. *Roberts*

157. Foreign Policy of the United States (D). (SS) Sources of American foreign policy, containment, international economic policy, deterrence, arms control, and disarmament. Prospects for the future. Emphasis on the period since World War II. One course. *Holsti*

158. Space and International Relations (D). (SS) A comparative and historical survey of the developments regarding space, emphasizing the relations between states and the international system. The concept of space from fantasy to historical reality, focusing on the role of science, industry, and the administrative state. One course. *Roberts*

159. Ambition and Politics (C-N). (SS) A theoretical examination of the role of ambition in politics, including works by or on Homer, Plato, Plutarch, Machiavelli, Shakespeare, Tocqueville, Nietzsche, and Hitler. One course. *Gillespie*

160. Contemporary Global Issues (D). (SS) See C-L: Comparative Area Studies 109; also C-L: Cultural Anthropology 109, History 109, and Sociology 175. One course. *Staff*

161S. Comparative Government and Politics: Africa (B). (SS) Nationalism, nation building, and problems of development in sub-Saharan Africa. C-L: African and Afro-American Studies 131S and Comparative Area Studies. One course. *Bates or Johns*

163. Gender, Politics, and Policy: The Third World Case (B). (SS) A comparative analysis of precolonial, colonial, and postcolonial politics and distribution of political power between women and men. C-L: Comparative Area Studies and Women's Studies. One course. *O'Barr*

164. Political Organizations (A). (SS) Using classical organization theory and research on decision-making behavior of the members of political organizations to study those organizations (such as political parties, labor unions, businesses, and public bureaucracies). One course. *Brehm*

165. Government and Politics of the Soviet Union (B). (SS) Analysis of the Soviet political system, emphasizing the sources of stability and instability and the responsiveness of its policies. Literature on the non-Soviet world (notably the United States) will be included. C-L: Comparative Area Studies. One course. *Hough*

166. Soviet Foreign Relations (D). (SS) Nature of the Soviet Union's relations with other states. Determinants and formulation of foreign policy. C-L: Comparative Area Studies. One course. *Hough*

167. International Law (D). (SS) Introduction to the main concepts and themes in public international law. The role of states and international organizations in international law, treaties, the law of the sea, human rights, self-determination, and European integration. The sources of international law and its impact on state action. One course. *Simmons*

168. Analysis of Political Decision Making (C-E). (SS) Surveys of some of the most prominent problems, methods, ideas, and findings that have emerged in recent theoretical studies of politics. Intellectual puzzles, speculative models and normative and explanatory applications, individual decision theory, game theory, and social choice theory. Not open to students who have taken Political Science 139. One course. *Niou*

170. Europe Transformed (D). (SS) Transformation in intra-European relations since 1980. Topics covered: the Cold War and its termination in Europe, Warsaw Pact dissolution, new roles for NATO, European Community, and United States in Europe. C-L: Comparative Area Studies. One course. *Grieco*

171. Politics of South African Apartheid (B). (SS) The South African political system in the twentieth century, with particular attention to the economic and ethnic roots of racial conflict. United States-South African relations. C-L: African and Afro-American Studies 171 and Comparative Area Studies. One course. *Johns*

173S. Political Economy of World Food Problems (B). (SS) Changing policies toward food production and distribution. Topics include American agricultural policy, international food and famine aid, and Third World agricultural development strategies. C-L: Comparative Area Studies. One course. *Johns*

174S. Political Biography (A). (SS) Nature of politics as revealed in the life histories of individuals. Readings in single biographies and autobiographies, but with some

comparative work. Students project their autobiographies toward possible political futures. One course. *Barber*

176A. Perspectives on Food and Hunger (B). (SS) See C-L: Interdisciplinary Course 120A; also C-L: Comparative Area Studies. One course. *Johns*

176B. Perspectives on Food and Hunger (B). (SS) See C-L: Interdisciplinary Course 120B; also C-L: Comparative Area Studies. One course. *Johns*

179. Ecological Crisis and Political Theory (C-N). (SS) Interconnections between various dimensions of the ecological crisis including: conceptions of self, nature, ecological ethics, and environmental justice as related to politics, economics, and new social movements. One course. *Coles*

180. Media in Comparative Perspective (B). (SS) See C-L: Interdisciplinary Course 182; also C-L: Canadian Studies, Comparative Area Studies, Film and Video, and Sociology 182. One course. *Paletz or Smith*

181. Marxism and Neo-Marxism (C-N). (SS) Development of Marxism from Marx to the present. Critiques of capitalist political culture; the methodological underpinnings of various theorists, the conceptions of self and society which have animated these critiques. Works by Marx, Engels, Luxemburg, Lenin, Adorno, Horkheimer, Marcuse, Gramsci, Lukacs, Merleau-Ponty, Sartre, Habermas. One course. *Coles*

182. Classical Political Philosophy (C-N). (CZ) Prerequisite: junior standing; open to sophomores by consent of instructor. See C-L: Classical Studies 173; also C-L: Philosophy 173. One course. *Staff*

184S. Canadian Issues (B). (SS) Prerequisite: Interdisciplinary Course 98 or consent of instructor. See C-L: Interdisciplinary Course 184S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 184S, Economics 184S, History 184S, and Sociology 184S. One course. *Cahow or Thompson*

186. Political Leadership (A). (SS) The development, characteristics, and impact of political leaders. Biographical and collective studies are considered primarily from a psychological perspective. One course. *Barber*

187S. Politics and the Libido (A). (SS) Effects of the libido on elite and mass political activities. Government regulation of sex-inspired behavior. C-L: Women's Studies. One course. *Paletz*

188. The Psychology of Political Symbols (A). (SS) The role of symbolic political issues in determining public attitudes and voting behavior. Symbolic political issues such as "law and order," pornography, and prohibition; distinguished from public welfare issues such as employment policies. C-L: Public Policy Studies 188. One course. *McConahay*

189, 190. Internship (A). Open to students engaging in practical or governmental work experience during the summer or a regular semester. To enroll, a student must obtain the approval of the Director of Undergraduate Studies. A faculty member in the department will supervise a program of study related to the work experience, including an analytical paper on a politics-related topic. One course each. *Staff*

191, 192. Independent Study (A, B, C, or D). Directed reading and research. Open only to qualified juniors by consent of the Director of Undergraduate Studies and of the supervising instructor. One course each. *Staff*

193, 194. Independent Study (A, B, C, or D). Directed reading and research. Open only to seniors by consent of the Director of Undergraduate Studies and of the supervising instructor. One course each. *Staff*

196. American University Washington Semester. This number represents transfer credit for American Government and Politics or International Relations topics courses taken at American University in the Fall or Spring Washington Semester Program: Seminar I (one course), Seminar II (one course), Research Project (one course), Internship (one course). Prior approval for admission into this program must be obtained from the Director of Undergraduate Studies in Political Science. Four transfer credits.

A. Programs in American Government and Politics

D. Programs in International Relations

Four courses.

199. Special Topics in Government and Politics. (SS) Topics vary from semester to semester.

A. American Government and Politics

B. Comparative Government and Politics

C. Political Theory

D. International Relations

One course. *Staff*

For Seniors Only

200H. Senior Honors Program (A, B, C, or D). (SS) Consent of instructor required.

.01 Great Books in Political Science. One course.

.02 Senior Thesis Design, Research, Writing. One course.

.03 Senior Thesis Writing and Defense. One course.

Variable credit. *Staff*

200S. Senior Seminars. (SS) Open also, if places are available, to qualified juniors who have earned a 3.0 average and obtain the consent of the instructor.

A. American Government and Politics

B. Comparative Government and Politics

C. Political Theory

D. International Relations

One course. *Staff*

For Seniors and Graduates*

201S. Problems in International Security (D). (SS) Major security issues. Prerequisite: a course in international relations or American foreign policy. One course. *Lomperis*

202. American Foreign Economic Policy (D). (SS) Formulation and implementation of American foreign economic policy in the twentieth century. Topics include theories of foreign economic policy-making, commercial and monetary policy, energy and agricultural policies, trade and security, aid to developing countries, management of the debt crisis, foreign investment, the industrial policy debate, and multinational corporations and banks. One course. *Simmons*

203S. Issues in Politics and the Media in the United States (A). (SS) Research seminar analyzing significant questions in the relationship between politics and the media of communication. Consent of instructor required. C-L: Film and Video. One course. *Paletz*

*The following courses may be taken by juniors who have earned a 3.0 average and obtained the consent of the instructor.

204S. Ethics in Political Life (C-N). (SS) Ethical issues arising in the conduct of political vocations and activities. C-L: Public Policy Studies 204S. One course. *Spragens*

205S. The Political Economy of Environmental Resources (B). (SS) The rational choice tradition (public goods, collective action, game theory, property rights, new institutionalism) as applied to environmental problems, resource exploitation, environmental justice, and the design of an environmentally sound society. One course. *McKean*

207S. American Constitutional Interpretation (A). (SS) U.S. Supreme Court interpretation of selected provisions of the Constitution. Prerequisites: Political Science 118 or 127 or 143 and consent of instructor. One course. *Fish*

208S. Analyzing the News (A). (SS) See C-L: Public Policy Studies 240S; also C-L: Film and Video. One course. *Paletz*

209. Problems in State Government and Politics (A). (SS) One course. *Staff*

210S. Models in International Relations (D). (SS) Emphasis on key theoretical concepts and modeling methodology beginning with basic game theory and decision theory. Such techniques are applied in analysis of deterrence, arms races, balance of power, hegemonic stability, and alliance formation. One course. *Niou*

212S. Domestic Structures and Foreign Policies of Advanced Democratic States (D). (SS) The influence of democratic institutions on the national-security and foreign-economic policies of advanced industrialized states. C-L: Comparative Area Studies. One course. *Grieco*

213S. Theories of International Political Economy (D). (SS) Comparison and assessment of traditional and modern theories in terms of their logical and empirical validity. One course. *Grieco*

216S. Evolution of European Marxism (C-N). (SS) The central themes in the evolution of European Marxism: socialist thought prior to Marx; the writings of Marx and Engels. The themes are articulated in: Russian Marxism; Soviet Communism and its Marxist critics; the rethinking of Marx's political economy, the theory of the state, and concepts of class consciousness in the works of twentieth-century European Marxists. C-L: Comparative Area Studies. One course. *Coles*

217. Comparative and Historical Methods (B). (SS) See C-L: Sociology 214; also C-L: Comparative Area Studies. One course. *Archer, Gereffi, Janoski, Smith, or Tiryakian*

218. Political Thought in the United States (C-N). (SS) American political thought through the Civil War period. The Founders and their European antecedents. Debates over the Constitution, slavery, and the Union. One course. *Gillespie or Grant*

219S. Film and Politics (A). (SS) Analysis of selected film genres and films as they illuminate political behavior. C-L: Film and Video. One course. *Paletz*

220S. Problems in International Politics (D). (SS) Prerequisite: one course in international relations, foreign policy, or diplomatic history. One course. *Holsti*

221S. International Institutions and the World Political Economy (D). (SS) Examination of theory concerning the role of international institutions in facilitating economic cooperation among advanced democratic states. Investigation of the impact on international economic relations of such multilateral institutions as the International Monetary Fund, the World Bank, the General Agreement on Tariffs and Trade, and the International Energy Agency. One course. *Grieco*

222. Introduction to Statistical Analysis (C-E). (QR) Basic applications of statistical theory to political questions: research design, hypothesis tests, computer data analysis. Consent of instructor required for undergraduates. One course. *Bianco, Brehm, or Gronke*

223. Ancient Political Philosophy (C-N). (SS) Intensive analysis of the political philosophy of Plato, Aristotle, and other ancient theorists. One course. *Gillespie or Grant*

224S. Modern Political Theory (C-N). (SS) A historical survey and philosophical analysis of political theory from the beginning of the seventeenth to the middle of the nineteenth century. The rise of liberalism, the Age of Enlightenment, the romantic and conservative reaction, idealism, and utilitarianism. One course. *Grant or Spragens*

225. Topics in Comparative Government and Politics: Western Europe (B). (SS) Topics vary: the development of mass democracy and the welfare state; political and electoral participation and mobilization; social movements and political change; center-periphery conflicts; government and bureaucratic institutions and their relationships to society; the modern welfare state and political economy. C-L: Comparative Area Studies. One course. *Kitschelt or Lange*

226S. Theories of International Relations (D). (SS) An overview with applications to political-military and political-economic empirical problems. One course. *Grieco*

227S. Issues in International Communications (B). (SS) Research seminar analyzing selected political issues in international communications. C-L: Film and Video. One course. *Palez*

228S. Nineteenth- and Twentieth-Century Political Philosophy (C-N). (SS) Topics in nineteenth- and twentieth-century political philosophy, considering such authors as Hegel, Marx, Nietzsche, Kant, Fichte, Dostoevsky, and Heidegger. One course. *Coles or Gillespie*

229S. Contemporary Theory of Liberal Democracy (C-N). (SS) One course. *Spragens*

230S. Introduction to Positive Political Theory (C-E). (SS) Basic concepts of political economy, theory of preference and choice, social choice theory, and decision and game theory. One course. *Aldrich, Bates, Bianco, or Niou*

231S. Crisis, Choice, and Change in Advanced Democratic States (B). (SS) Contributions of Marx, Weber, and Durkheim toward analysis of modern democracies. Examination of selected contemporary studies using these three perspectives to highlight processes of change and crisis. Unsettling effects of markets upon political systems, consequences of bureaucratic regulation, and transformation of sources of solidarity and integration in modern politics. C-L: Comparative Area Studies. One course. *Kitschelt*

232. Political Economy: Theory and Applications (C-E). (SS) Selected topics. C-L: Comparative Area Studies. One course. *Lange*

233. Intermediate Statistical Methods (C-E). (QR) Applications of regression models of politics emphasizing the effect of assumptions behind Generalized Least Squares regression. Prerequisite: Political Science 222; consent of instructor required for undergraduates. One course. *Bianco, Brehm, or Gronke*

234S. Political Economy of Development: Theories of Change in the Third World (B). (SS) Alternative approaches to political economy and social change in the Third World. C-L: Comparative Area Studies, Cultural Anthropology 234S, History 234S, Interdisciplinary Course 234S, and Sociology 234S. One course. *Staff*

235S. Comparative Development of Islam (B). (SS) Comparative development of Islam in Indonesia, Malaysia, Pakistan, India, North Africa, and sub-Saharan Africa. A comparative analysis of the resurgence of Islam as a religious, political, and cultural force. C-L: Comparative Area Studies. One course. *Staff*

236S. Hegel's Political Philosophy (C-N). (SS) Within context of Hegel's total philosophy, an examination of his understanding of phenomenology and the phenomenological basis of political institutions and his understanding of Greek and Christian political life. Selections from *Phenomenology*, *Philosophy of History*, and *Philosophy of Right*. One course. *Gillespie*

237S. Comparative Public Policy (B). (SS) Introduction to methods, concepts, and theories of comparative public policy analysis. Substantive policies examined in the course vary each semester and may include economic, industrial, social, and civil rights policies. C-L: Comparative Area Studies. One course. *Kitschelt*

238S. Development of United States Courts of the Fourth Circuit (A). (SS) Examines judges, courts, and law of United States district and old circuit courts and Court of Appeals: Maryland, Virginia, West Virginia, North Carolina, South Carolina, 1789-1958. One course. *Fish*

239. Comparative History and International Relations (D). (SS) Forces central to the practice of politics and international relations. Theoretical perspectives include those of Oswald Spengler, Schumpeter, Marx, Weber, and Aron as well as historical cases such as the Russian Revolution, the world wars, the Depression, and the nuclear era. One course. *Roberts*

240. American Political Behavior (A). (SS) One course. *Staff*

241S. The Political Thought of Asia from Manu to Mao (C-N). (SS) The development of political thought in Asia emphasizing China and India with consideration of Southeast Asia and Japan. Political treatises of classical India and China, various intellectual responses to European colonialism, and the nationalism, communism, and liberalism of modern Asia. Prerequisites: Political Science 94 or equivalent, and Political Science 132 or equivalent. C-L: Comparative Area Studies. One course. *Lomperis*

243S. Political Applications of Game Theory (C-E). (SS) Theory of games as a tool to understand strategic behavior of political actors. Applications to legislative politics, international cooperation, bureaucratic behavior. One course. *Bianco or Niu*

244S. The Politics of the European Community (D). (SS) Historical, theoretical, and analytical treatment of reform and renewal of the European Community: trade, finance, economic and technological relationships. Impact of European Community development on international relations and American foreign policy. One course. *Grieco*

245. Ethics and Policy-Making (C-N). (SS) Not open to students who have taken Public Policy Studies 116. See C-L: Public Policy Studies 223. One course. *Rapaport*

246S. Political Hypocrisy and Idealism (C-N). (SS) The cases for and against hypocrisy in political and social life. The concept of authenticity as the alternative to hypocrisy. Selections from Machiavelli, Shakespeare, Rousseau, Nietzsche, and others. One course. *Grant*

247. Politics and Philosophy of Self and Other (C-N). (SS) Epistemological, ontological, ethical, and political dimensions of relations between self and other. Theorists may include Husserl, Merleau-Ponty, Levinas, Derrida, Adorno, Gadamer, Sartre, Foucault, and Bakhtin. One course. *Coles*

248. The Politics of the Policy Process (A). (SS) See C-L: Public Policy Studies 219. One course. *Ascher or Mayer*

250S. International Security after the Cold War (D). (SS) Contemporary issues in international security: nuclear proliferation, balance of power, the role of force, alternative viewpoints. Consent of instructor required. One course. *Feaver*

251S. The American Presidency (A). (SS) One course. *Paletz*

252S. The Nation-State and the International System (D). (SS) The interaction between state structures and the international system. Topics include war, nationalism, and state formation; war and national revolution; imperialism and decolonization; and economic dependency and national autonomy. One course. *Grieco*

253S. Comparative Government and the Study of Latin America (B). (SS) Current literature on major themes of Latin American politics. C-L: Comparative Area Studies. One course. *Archer*

255. Political Sociology (B). (SS) See C-L: Sociology 255; also C-L: Canadian Studies. One course. *Smith or Tiryakian*

256S. Arms Control and National Security Policy (D). (SS) The evolution of nuclear weapons and strategy and of global defense policy toward the Soviet Union and other adversaries; the arms control process and nonproliferation. Consent of instructor required. One course. *Lomperis*

257S. Making American Defense Policy (D). (SS) Theory and practice of politics of national security in the United States. One course. *Feaver*

259S. Low Intensity Conflict and the Lessons of Viet Nam (D). (SS) The Viet Nam conflict and comparative cases; implications for Western interventions in the Third World. Consent of instructor required. C-L: Comparative Area Studies. One course. *Lomperis*

260S. The Tradition of Political Inquiry (C-N). (SS) Past and present problems, goals, presuppositions, and methods. One course. *Spragens*

262S. International Communism (B). (SS) C-L: Comparative Area Studies. One course. *Hough*

263S. Methods of Political Science (C-E). (SS) The relation between theory and evidence; research designs for the comparative analyses of historical and statistical evidence. One course. *Roberts*

265S. The Process of International Negotiation (D). (SS) See C-L: Public Policy Studies 265S; also C-L: Canadian Studies. One course. *Mayer*

266S. Comparative Social Policy (B). (SS) See C-L: Public Policy Studies 266S; also C-L: Comparative Area Studies. One course. *Smith*

267S. Policy-Making in International Organizations (D). (SS) See C-L: Public Policy Studies 267S. One course. *Ascher*

268. The Regulatory Process (A). (SS) See C-L: Public Policy Studies 269. One course. *Hamilton*

270S. Fundamentals of Political Economy (C-E). (SS) Application of economic reasoning to the study of politics. Analysis of campaigns and elections; legislatures; and the regulation of industries. C-L: Economics 270S. One course. *Aldrich, Bates, Bianco, or Niou*

275. The American Party System (A). (SS) An intensive examination of selected facets of American national political parties, such as relationships between presidential and congressional politics, the politics of national conventions, recent foreign policy and party alignments, and the controversy over party government. One course. *Kornberg*

277. Comparative Party Politics (B). (SS) The impact of social and political systems on party structures, functions, ideologies, and leadership recruitment. Emphasis upon research techniques and objectives. C-L: Canadian Studies and Comparative Area Studies. One course. *Kornberg or Lange*

279S. Political Protest and Collective Mobilization (B). (SS) Survey of theories, methods, and empirical studies of political mobilization outside institutional channels; protest behavior and strategies; responses of the state to these challenges; the success of collective mobilization. Emphasis on comparative analyses of protest in advanced industrial democracies. One course. *Kitschelt*

282S. Canada (B). (SS) See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Economics 282S, Interdisciplinary Course 282S, and Sociology 282S. One course. *Cahow or Thompson*

283S. Congressional Policy-Making (A). (SS) Lawmaking and oversight of the executive branch by the U.S. Congress. Committee, party, executive, and interest group roles. C-L: Public Policy Studies 283S. One course. *Bianco or Gronke*

284S. Public Policy Process in Developing Countries (B). (SS) See C-L: Public Policy Studies 284S; also C-L: Comparative Area Studies. One course. *Ascher*

293. Federalism (B). (SS) Theoretical and operational aspects of federal systems of government, focusing on the United States and Canada. C-L: Canadian Studies and Comparative Area Studies. One course. *Staff*

299. Advanced Topics in Government and Politics. (SS) Topics vary from semester to semester.

- A. American Government and Politics
 - B. Comparative Government and Politics
 - C. Political Theory
 - D. International Relations
- One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

112S. Shaping the News (A). (SS)

116S. The Small Democracies in Europe (B). (SS)

169. Politics in Revolutionary China (B). (SS)

183D. Hellenistic Philosophy (C-N). (CZ)

195. Comparative Political Behavior in the United States and Canada (B). (SS)

211S. Current Problems and Issues in Japanese Politics (B). (SS)

214S. The Politics of Scarcity (B). (SS)

215S. Philosophical Bases of Political Economy and Society (C-E). (SS)

261. Politics and the Future (D). (SS)

280S. Comparative Government and Politics: Sub-Saharan Africa (B). (SS)

POLITICAL INTERNSHIPS

The department administers an internship program, primarily in Washington, D.C., for political science majors and interested nonmajors. Students participate by qualifying for a position obtained by the department or by acquiring their own relevant employment, with or without compensation. Course credit can be obtained by enrolling in Political Science 189 or 190 and writing an analytical paper on a politics-related topic. Potential applicants should contact the Internship Director, Louise Walker (339 Perkins), at any time, but preferably in the fall semester.

POLITICAL SCIENCE COURSES BY FIELDS

Political science courses for undergraduates are offered in four fields. The courses in each of the four fields are listed below; in the course descriptions above, the field in which each course falls is indicated by the appropriate symbol (A, B, C-N/C-E, or D). Students majoring in the department must complete at least one course in each of three fields.

American Government, Politics, and Public Administration (A). Political Science 49S,* 91, 91D, 100D, 101A,S, 103, 108, 109, 110, 112S, 118, 127, 128, 129, 130S, 137, 143, 145, 146, 152, 154, 164, 174S, 186, 187S, 188, 189, 190, 191,* 192,* 193,* 194,* 196, 197S-198S,* 199A, 200A,S, 203S, 207S, 208S, 209, 219S, 238S, 240, 248, 251S, 268, 275, 283S, 299A.

Comparative Government and Politics (B). Political Science 49S,* 92, 92D, 98, 100B, 100C, 100D, 100E, 100F, 100H, 101B,S, 102, 105, 107, 111, 115, 116S, 117, 125, 132, 135, 136, 151, 153, 155, 161S, 162, 163, 165, 169, 171, 173S, 176A, 176B, 180, 184S, 191,* 192,* 193,* 194,* 195, 197S-198S,* 199B, 200B,S, 205S, 211S, 214S, 217, 225, 227S, 231S, 234S, 235S, 237S, 249, 253S, 255, 262S, 266S, 277, 279S, 280S, 282S, 284S, 293, 299B.

Political Theory: Normative (C-N). Political Science 49S,* 94, 94D, 101C,S, 104, 123, 126, 131, 140, 150, 159, 179, 181, 182, 183D, 191,* 192,* 193,* 194,* 197S-198S,* 199C-N, 204S, 215S, 216S, 218, 223, 224S, 228S, 229S, 241S, 245, 246S, 247, 260S, 264S, 299C-N. **Empirical and Methodology (C-E).** Political Science 138, 139, 168, 191*, 192*, 193*, 194*, 197S-198S*, 199C-E, 215S, 222, 230S, 232, 233S, 243S, 263S, 270S, 299C-E.

International Law, Relations, and Politics (D). Political Science 49S,* 93, 93D, 100C, 100G, 106, 113, 119, 120, 121, 122, 124, 133, 134, 142, 144, 147, 149, 156, 157, 158, 160, 166, 167, 170, 191,* 192,* 193,* 194,* 197S-198S,* 199D, 200S,D, 201S, 202, 206, 210S, 212S, 213S, 220S, 221S, 226S, 239, 244S, 250, 252, 256S, 257S, 259S, 261, 265S, 267S, 299D.

THE MAJOR

Requirements. Eight courses in political science including (1) at least one course in each of three fields; (2) at least one course at Duke at the 200-299 level; and (3) no more than three cross-listed courses originating outside the Department of Political Science.

Of the eight required political science courses, at least six must be taken at Duke to meet major requirements. However, only five Duke political science courses need be taken if the student: (1) is transferring courses from a year-long approved study abroad program; or (2) transferred to Duke after completing two undergraduate years at another institution; or (3) completed one semester at an approved study abroad program and one semester in the Washington Semester Program at American University. For the purpose of this requirement courses in the Washington Semester Program at American University (Political Science 196, I-IV) will be counted as transfer courses.

*If subject matter is appropriate to the field.

Advanced Placement Credit. Advanced placement credits in political science (score of 4 or 5). These course credits are designated as Political Science 90A (American Government and Politics) and Political Science 90B (Comparative Government and Politics). Such credits are applied toward the thirty-four credits needed for graduation and enable students to enroll in any 90-level introductory course(s) and permit them to enroll in advanced American and/or Comparative Government course(s). Advanced placement course credits (90A, 90B) do not satisfy course requirements for the political science major.

Suggested Work in Related Disciplines. Selected courses in such disciplines as anthropology, economics, history, philosophy, psychology, public policy, religion, and sociology are desirable.

Honors/Distinction. The department offers students majoring in political science a senior honors program, by successful completion of which a participant achieves graduation with distinction in political science. The central requirement of the program is an honors thesis which the student prepares under faculty supervision. The honors program consists of three courses. The prerequisite is Political Science 200H.01 (Great Books in Political Science), usually taken in the second semester of the junior year. This course is open to all juniors and seniors, but registration priority is accorded those juniors who are qualified candidates for admission into the Senior Honors Seminar (Political Science 200H.02). Seniors entering their seventh semester who have attained at least a 3.3 grade point average overall and a 3.5 average in political science courses are eligible for admission to this seminar. Also eligible for admission are any other entering seventh-semester seniors who have performed in Political Science 200H.01 to the satisfaction of the instructor. Upon request, that instructor may recommend admission to the honors seminar of a student who lacks one or both requisite grade point averages. The Program Director must approve any recommended student's admission.

Qualified juniors will be invited during the fall semester of their junior year to enroll in Political Science 200H.01 to be offered during the ensuing spring semester. Interested students will review their academic plans with the Program Director for permission to enroll in a course examining leading political science literature. Political Science 200H.02, a seminar usually taken in the fall of the senior year, is devoted to development of the honors thesis and includes close supervision of the writing stage of the project by a faculty supervisor selected by the student. Continued close faculty supervision of the project occurs in Political Science 200H.03, which is an independent study course.

Completion of the thesis, its evaluation, and its defense before a three-member faculty committee warrants graduation with distinction in political science if a grade of A- or better is assigned to the student's thesis and performance in Political Science 200H.02 and 200H.03. The intradepartmental concentration option is partially satisfied by successful completion of the two-course senior honors thesis seminar. Further information may be obtained from the Honors Program Director or from the Director of Undergraduate Studies.

Latin Honors by Honors Project. A major in political science who wishes to be a candidate for Trinity College Latin honors by honors project must: (1) have an overall grade point average of 3.5 in political science at the commencement and termination of the project, (2) enroll in and successfully complete the Senior Honors Program (Political Science 200H.01, .02, .03), (3) provide written notice to the faculty director of that program and to the Director of Undergraduate Studies of an intention to seek Latin honors. Following the candidate's oral defense of the honors thesis, the three-member examination committee, which has determined that the candidate merits graduation with distinction in political science, will evaluate the candidate's eligibility for any level of Latin honors. The director of the Senior Honors Program, who also serves as a member of the Undergraduate Affairs Committee of the Department of Political Science, will so advise the committee. If the candidate is deemed to be eligible for Latin honors by honors

project, that committee will evaluate the candidate's performance in the honors program and his or her overall academic performance in the major and in the full course of study at Duke, and, if warranted, will certify such candidate for a specific level of Latin honors.

Psychology (PSY)

Faculty in Psychology—Experimental: Professor Lockhead, *Chair*; Professor R. Erickson, *Director of Undergraduate Studies*; Professors Brodie, Eckerman, C. Erickson, W. G. Hall, Holland, Rubin, Staddon, and M. Wallach; Associate Professors Day and Marsh; Assistant Professor Needham; Professors Emeriti Bevan, Diamond, Kimble, Kremen, and Wing; Assistant Professor of the Practice Conley; Research Professors Crovitz, W. C. Hall, S. Schiffman, Swartzwelder, and L. Wallach; Adjunct Assistant Professors Cooper and Izard

Faculty in Psychology—Social and Health Sciences: Professor Costanzo, *Chair*; Professor Martin Lakin, *Director of Undergraduate Studies*; Professors Bettman, Brodie, Carson, Coie, Craighead, George, Hamilton, Hasher, Maddox, Payne, Roth, Surwit, Thompson, Vidmar, and Williams; Associate Professors Anderson, Blumenthal, Curry, Keefe, Linville, Lochman, Logue, Putallaz, Sheppard, and Spenner; Assistant Professors Gil, Emery, Fischer, Fredrickson, and Mazuka; Professors Emeriti Alexander, Borstelmann, and H. Schiffman; Assistant Professors of the Practice Musia Lakin and Terry; Research Professor Goldstein

A major is available in this department.

The major in psychology is cooperatively administered by the Department of Psychology: Experimental and the Department of Psychology: Social and Health Sciences. Faculty with appointments in both departments are listed only in their primary department. The Director of Undergraduate Studies in either department guides all majors and all students interested in any psychology courses. However, Dr. Martin Lakin (Director of Undergraduate Studies, Social and Health Sciences) has primary responsibility for the personality and social and health tracks of the major, and Dr. R. Erickson (Director of Undergraduate Studies, Experimental) has primary responsibility for the biological and cognitive tracks of the major; either may be consulted by students with interests in the developmental track.

The *General Courses*, coded (G), apply as indicated. The *Biological Bases of Behavior* area, coded (B), includes courses on the nervous system, the learning process, motivation, neurochemistry, hormones, and other biological factors in their relationship to behavior. The *Cognitive Psychology* area, coded (C), includes the topics of sensation and perception, cognition, learning, language, memory, and psycholinguistics. *Developmental Psychology*, coded (D), emphasizes the developmental aspects of all psychological processes such as sensory and motor behavior, cognition, children's thinking and reasoning, and social behavior. *Health Psychology*, coded (H), involves study of behavioral implications of illness and health. The courses involve understanding sources and treatment of psychopathology due to stress, trauma, and disease. Courses in the *Personality/Social Psychology* area, coded (P), ultimately bear on the questions of human character and behavior, both normal and abnormal. These include personality, social and abnormal issues, along with strategies for the prevention of deviance.

11. Introductory Psychology (G). (SS) Biological bases of behavior, psychological development, cognitive psychology, personality, abnormal behavior, and social psychology. Designed as a broad introduction to psychology for nonmajors as well as majors; not required for the major. Students are expected to participate as subjects in three to six hours of psychological research. One course. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

103. Biological Bases of Behavior: Introduction and Survey (B). (NS) Physiological, developmental, and evolutionary approaches to behavior. Sensory and cognitive processes, sleep, pain, emotion, hunger, and thirst as well as maternal and sexual behavior patterns. Students required to participate as subjects in three to six hours of psychological research if not done in a previous introductory class. Prerequisite: Biology 19, Biology 21L, or Biology 22L; may be taken concurrently. One course. *C. Erickson or staff*

105. Developmental Psychology: Introduction and Survey (D). (SS) Theory and research on growth and behavior from infancy to adolescence. Students required to participate as subjects in three to six hours of psychological research. One course. *Goldstein, Mazuka, Needham, Putaliez, or staff*

107. Cognitive Psychology: Introduction and Survey (C). (SS) Overview of cognitive processes including pattern recognition, concept formation, attention, memory, imagery, language, problem solving, and thinking. Emphasis both empirical and theoretical. Students required to participate as subjects in three to six hours of psychological research. One course. *Day, Hasher, or Rubin*

108. Personality and Social Behavior: Introduction and Survey (P). (SS) The determinants of socially significant human behavior—those residing in the person, those that are the product of interpersonal context, and those resulting from the interaction of both sources. Formative as well as contemporary influences considered. Students required to participate as subjects in three to six hours of psychological research. One course. *Carson or Costanzo*

109. Health Psychology: Introduction and Survey (H). (SS) The role of behavioral variables in the etiology, pathophysiology, and treatment of cardiovascular disease and endocrine disorders; psychoneuroimmunology; chronic pain; and life style behaviors with health consequences such as smoking and eating disorders. Students required to participate as subjects in three to six hours of psychological research if not done in a previous introductory class. One course. *Anderson and Gil*

110. Applied Psychology (P). (SS) Applications of psychology to problems of personnel selection, industrial efficiency, advertising, and selling. Prerequisite: Psychology 117 or equivalent. One course. *Staff*

111. Learning and Adaptive Behavior (B, C). (NS) Principles of instrumental learning in animals and humans. Prerequisite: none, but some knowledge of quantitative science desirable. One course. *Staff*

112. Sensation and Perception (C). (SS) Principles of organization of perceptual systems, including sensory systems (vision, audition, proprioception, and chemical senses); pattern recognition; perceptual anomalies; attention; methods of measurement. One course. *Lockhead*

114. Personality (P). (SS) Representative theories of personality from Freud to the present, emphasizing problems of normal personality structure, dynamics, development, and assessment. One course. *Staff*

115. Introduction to Learning Theory (C). (SS) Simple processes of learning, memory, and motivation, primarily nonhuman, from the perspectives of associationism, ethology, and cognitive science. One course. *Holland*

116. Social Psychology (P). (SS) Problems, concepts, and methods in the study of social interaction and interpersonal influence. C-L: Sociology 106 and Women's Studies. One course. *Costanzo, Fischer, or George*

117. Statistical Methods (G). (QR) Elementary statistical techniques and their application to the analysis and interpretation of social science data. Theory of inference is stressed. C-L: Sociology 133. One course. *Staff*

118. The Psychology of Individual Differences (B, C, D, P). (SS) Nature and causes of individual and group variations in intelligence, special abilities, social and emotional characteristics. Prerequisite: Psychology 117 or equivalent. One course. *Staff*

119. Abnormal Psychology (H, P). (SS) Disordered behavior and constructive personality change viewed in interpersonal and social context for purposes of understanding normal and abnormal personality development and functioning. One course. *Carson or Craighead*

120. Comparative Psychology (B). (SS) A survey of animal behavior from the psychologist's perspective. Analysis of several specific behaviors: such as navigation, communication, social organization. One course. *Holland*

123. Introduction to Human Memory (C). (SS) A review of the theoretical and empirical study of the encoding, storage, and retrieval of information. The development, pathology, and computer modeling of memory in clarification of basic process and applications. One course. *Hasher or Rubin*

124. Human Development (D). (SS) Especially for sophomores. Juniors and seniors by consent only. See C-L: Interdisciplinary Course 124; also C-L: Human Development and Sociology 124. One course. *N. Anderson and staff*

125. Memory and the Brain (B). (NS) Brain function in relation to the phenomenon of memory. Historical and current perspectives. One course. *Swartzwelder*

126. Behavior and Neurochemistry (B, P). (NS) The role of brain chemicals (neurotransmitters, peptides, and hormones) in behavior. Hypotheses addressing the neurobiology of mental disorders. Prerequisite: Psychology 103. One course. *Cooper*

127. Drugs, Brain, and Behavior. (NS) Mechanisms by which psychoactive drugs act. Changes which occur with chronic use of drugs; drug abuse and dependence. Social and legal implications of psychoactive drugs. Prerequisites: introductory biology (Biology 21L, 22L) and chemistry (Chemistry 11L, 12L). C-L: Pharmacology 160. One course. *Kuhn*

128. Memory Disorders (C). (SS) Examines human memory disorders and their implications for cognitive theory practice. Topics include specific disorders such as head injury and Alzheimer's disease; memory complaints in normal people; and mnemonics and other methods used to bypass poor memory ability. Psychology 107, 123, or other courses in cognitive psychology are recommended as background for this course. One course. *Crovitz*

130. Psychosocial Aspects of Human Development (D). (SS) The connectedness of societal, behavioral, and biological components of normal development from childhood through old age; society as the context in which individuals develop over the life span. Introductory work in anthropology, psychology, or sociology recommended. C-L: Human Development, Interdisciplinary Course 180, and Sociology 169. One course. *Martin Lakin and Maddox*

131. Early Social Development (D). (SS) The developmental course of children's social behavior. The role that certain relationships (for example, mother, father, siblings, peers, friends) play in that development as well as the effects of other influences (for example, school, television, divorce, daycare). Prerequisite: Psychology 105. One course. *Putallaz*

132. Cognitive Aspects of Human Development (C, D). (SS) The development of mind and its relation to other aspects of human development. Development of visual and auditory perception, language, memory, concepts, problem solving, academic skills, social cognition, and cognition and culture. Prerequisite: one course in psychology. One course. *Mazuka*

133. Fundamental Issues in the Study of the Brain (B). (NS) Classic papers in the fields of systems, developmental, cellular, and molecular neurobiology. Prerequisite: Psychology 135. One course. *W. C. Hall*

134. Psychology of Language (C). (SS) Psychological "reality" of linguistic structures, language and cognition, biological bases, animal communication, language pathologies, nonverbal communication, language versus music, linguistic universals, and bilingualism. Everyday language phenomena (for example, slips of the tongue) as well as the experimental and theoretical literature. Psychology 107 desirable. C-L: Linguistics. One course. *Day*

135. Principles of Neurobiology (B). (NS) Prerequisites: Biology 21L and 22L; and Chemistry 12L or equivalent. See C-L: Biology 154. One course. *Nowicki*

136. Developmental Psychobiology (D). (SS) Early human social development, including the formation of social relationships, the origins of altruism and aggression, sex differences, peer relationships, and verbal and nonverbal communication patterns. Prerequisite: Psychology 103, 105, or consent of instructor. One course. *Eckerman*

137. Adolescence (D). (SS) Adolescent development, including identity formation, intelligence, sexuality, peer and parent relationships, vocational choices, drugs, and psychopathology. Theory and empirical findings. One course. *Goldstein*

138. Language Development (C, D). (SS) Survey of language development. First language acquisition (phonology, syntax, and semantics), issues in second language acquisition and bilingualism, chimpanzee studies, and language pathology. Examined in a theoretical framework of Chomskian innate language faculty, as well as in a framework which emphasizes the role of pragmatics and communicative skills. Prerequisite: one course in developmental or cognitive psychology. C-L: Linguistics. One course. *Mazuka*

139. Psychobiology of Motivation (B, D). (NS) The psychobiology of such concepts as motivation, drive, incentive, reward, and goal-directed behavior. The neural mechanism; developmental perspectives. Prerequisite: Psychology 103. One course. *Staff*

140S. Research Methods in Developmental Psychology (D). (SS) Prerequisite: Psychology 105 or consent of instructor. One course. *Eckerman or L. Wallach*

141S. Tests and Measurements (B, C, D, P). (SS) Test methods used by psychologists to measure and evaluate mental processes. Prerequisite: Psychology 117 or equivalent. One course. *Terry*

142S. Child Observation (D). (SS) Observation of children in the group setting of the University Preschool and Primary Program. Aspects of personality, social development, and child-adult relationships. Open only to junior and senior psychology majors with consent of instructor. One course. *Musia Lakin*

143S. Cognition Laboratory (C). (SS) Human cognition; language, memory, problem solving, and other higher mental processes. Prerequisite: Psychology 107 or 112 or 123. One course. *Hasher, Lockhead, or Rubin*

145S. Experimental Approaches to Personality (P). (SS) Methods applied to personality research. Prerequisite: one course in psychology. One course. *M. Wallach*

146S. Research Methods in Health and Clinical Psychology (H). (SS) Contemporary approaches to psychologically based research in health and mental health. Survey, laboratory, and/or narrative self-report methodologies. Class research projects. Prerequisites: Psychology 108, 116, or 119, and Statistics 110. One course. *Blumenthal and Keefe*

147S. Experimental Social Psychology (P). (SS) Group dynamics, attitude change, and interpersonal perception. Prerequisite: Psychology 116. One course. *Staff*

148S. Perception Laboratory (C). (SS) Experimental approaches to basic phenomena of perception as determined by conditions in the external situation and the person: biological and psychological. Prerequisite: Psychology 112 or consent of instructor. One course. *Lockhead*

149S. Methods in Behavioral Neurobiology (B). (NS) Research in neural bases of behavior using simple biological systems as models for more complex behavior. Laboratory experience in experimental methodologies. Observational techniques in study of natural behaviors and neurophysiological recording and stimulation. Prerequisites: Psychology 103 or background in biology, and consent of instructor. One course. *W. G. Hall and staff*

150S. Hormones and Behavior (B, P). (NS) The endocrine system and hormones in aggressive, sexual, and emotional behavior. Prerequisite: Psychology 103. C-L: Women's Studies. One course. *Izard*

152S. Community Psychology (D, P). (SS) Community problems and their possible solutions through observation in various community settings involving children, primarily in the Durham City Schools. Consent of instructor required. One course. *Staff*

153S. Issues in Language Development (C, D). (SS) "Critical Period" in language development, the role of "motherese," infant speech perception, innovative word creation, telegraphic speech, bilingualism and second language learning, learning to read, language, cognition and culture, and language pathology. One course. *Mazuka*

154S. Education, Children, and Poverty (D). (SS) Psychological hypotheses concerning the roles of preschool intervention programs, improved quality of resources, teacher expectancy effects, and enhancement of pupil self-confidence in relation to the goal of improved cognitive competence for poverty background children. Criteria for defining competence, such as scores on psychometric intelligence tests, performing on Piagetian tasks, and development of specific skills. Interpretations concerning intelligence and cognitive deprivation in poor children in light of relevant psychological evidence. Prerequisite: one course in psychology or consent of instructor. One course. *M. Wallach*

157S. Life Span Analysis of Social Relationships (D). (SS) The developmental changes that occur in social relationships (for example, parent, sibling, peer) across the life span; the differing roles these relationships play in the development of the individual. Prerequisite: Psychology 105. One course. *Putallaz*

158S. Sleep Seminar (B). (NS) Explores the phenomena of sleep over the full range of biological and psychological aspects. Function of sleep and consequences of sleep loss and change. Sleep disorders. Prerequisite: Psychology 103. One course. *Marsh*

159S. Biological Psychology of Human Development (B, D, H, P). (SS) Multidisciplinary perspectives bearing on key processes in human development from infancy through old age; the way that biological and psychological processes act together in normal and pathological behavior and development. Clinical case material and videotapes. Preference given to senior psychology majors and to students in the Program in Human Development. Consent of instructor required. One course. *Thompson*

162S. Clinical Issues: Conceptions, Techniques, and Problems of Professional Clinical Psychology (H, P). (SS) Assessment of personality and psychopathology. Consultation and psychotherapy in individuals, groups, family, and organizational contexts. Research on clinical questions. Intended for those contemplating advanced graduate or professional study and careers in clinical psychology, counseling, psychiatry, social work, or cognate fields. Prerequisites: junior or senior status and consent of the instructor. One course. *Martin Lakin*

164S. Psychology of Women (P). (SS) The psychology of women in this country: development, including sex differences, separation and individuation, and achievement; sexuality; sex-roles; mental health problems particularly salient to women; cultural influences on female development; and views within the field of psychology about women. Consent of instructor required. C-L: Women's Studies. One course. *Hamilton or Roth*

165S. Neurobiology of Learning and Memory (B). (NS) Readings in the neurophysiological and neurochemical underpinnings of the memory process. Current and classical research and review articles. Prerequisite: Psychology 103. One course. *Swartzwelder*

167S. Brain Mechanisms of Behavior (B, C). (NS) General physiological principles of brain organization in relation to behavioral processes from sensation to concept formation. Discussions of original readings from seminal papers in the early nineteenth century to the present. Prerequisite: Psychology 103. One course. *R. Erickson*

168S. Neuroethology (B). (NS) The neural basis of behavior in the laboratory combined with study of behavior in natural settings using animal examples. Prerequisite: Psychology 103 or equivalent. One course. *Smith*

169S. Eating Behavior and Disorders (B). (SS) The interaction of taste and smell with obesity, anorexia, and nutritional status including that of the elderly. Prerequisite: Psychology 103. One course. *Schiffman*

170S, A-R, U-Z. Selected Problems. New courses not yet in the bulletin are designated as 170S or 270S depending on their level. Since all faculty offer these courses, their contents vary accordingly. Different courses indicated by the letter. One course. *Staff*

171T, A-R. Tutorials. Small group discussions about influential books and articles in psychology. The availability of tutorials, their content, and the instructors will be announced before registration. Consent of instructor required. Pass/fail grading only. Half course. *Staff*

173S. Theoretical Issues in General Psychology (C, D, P). (SS) In-depth consideration of certain issues that cut across different areas of psychology: Are human beings bound to act in their own interests, or can they be genuinely altruistic? What do we mean when we talk about the mind or mental states, how do we know about these states in others as well as ourselves, and how are these states related to the body? Is psychology a science? Should it try to be, can it be, a science? One course. *L. Wallach*

174S. Computational Models and Perception (C). (SS) Relations between perception (including, for example, visual illusions and size constancy) and recent computer models. One course. *Crovitz and Lockhead*

175S. Psychophysiology (B). (NS) How emotional and cognitive processes are expressed physiologically, and how this can be used to understand how the brain works. Special attention given to how electrical activity of the brain is related to memory, selective attention, and decision making. A course in biological psychology (for example,

Psychology 103) or cognitive psychology (for example, Psychology 107) provides the proper background, but is not required. One course. *Marsh*

189S. Building the Brain. (NS) Recommended background: Psychology 103, Biology 154, Biology 21L and/or Biology 22L. Open only to juniors and seniors. See C-L: Distinguished Professor Course 189S; also C-L: Human Development, Neurobiology 189S, and Neurosciences. One course. *Purves*

191, 192, 193, 194. Independent Study. Directed reading and research. 191, 192: junior year fall, spring; 193, 194: senior year fall, spring. Consent of instructor and Director of Undergraduate Studies required. One course each. *Staff*

For Advanced Undergraduates and Graduates

204S. Great Ideas in Psychology (C). (SS) Ideas in psychology drawn from various content areas (for example, perception, personality, motivation, biological bases, social, cognitive, developmental, learning, clinical) and various methodological approaches (for example, experimental, introspection, observation, interview, longitudinal, simulation). Prerequisites: must be a junior or senior psychology major and have consent of instructor, or have graduate status. One course. *Day*

205S. Children's Peer Relations (D). (SS) An examination of the empirical literature with emphasis on the functions that peers serve for children, the developmental course of these relationships, the clinical ramifications and possible explanations for inadequate peer relations (including an examination of the family's role), and interventions used to improve children's relationships with their peers. Consent of instructor required. One course. *Putallaz*

206S. Pediatric Psychology (H). (SS) The conceptual and methodological bases for the field. Case material illustrating how developmental, biological, and psychosocial processes act together in child health and illness. Focus on adjustment and coping with illness and treatments related to cystic fibrosis, sickle cell disease, cancer, diabetes, and seizure disorders. Consent of instructor required. One course. *Thompson*

210S. Cognition (C). (SS) Schematic view of cognitive psychology plus intensive study of two to three specific research topics such as forms of representation, individual differences, and problem-solving models. Emphasis on alternative experimental and theoretical approaches. Prerequisites: Psychology 107 and consent of instructor, or graduate status. One course. *Day*

212S. Human Memory (C). (SS) Classical and modern literature, data, and theories relating to mechanisms of information processing, storage, and retrieval. Prerequisite: consent of instructor or graduate status. One course. *Hasher or Rubin*

214S. Development of Social Interaction (D, P). (SS) Major concepts and methods pertaining to early social development, emphasizing human social behavior and a developmental psychobiological approach. Consent of instructor required. One course. *Eckerman*

215S. Cognitive Development (C, D). (SS) Intensive critical evaluation of major approaches to the development of knowledge, including those of Piaget, Thomas Kuhn, Vygotsky, Eleanor Gibson, Kohlberg, and others. Consent of instructor required. One course. *L. Wallach*

217S. Advanced Social Psychology (P). (SS) The psychology of interpersonal influence and control; the cognitive and social factors affecting the perception of persons and social action; the dynamics of interpersonal relations and relationship formation and change; the contribution of individual differences to social behavior. Applications

in environmental psychology, social psychology and law, and organizational psychology. Prerequisite: consent of instructor or graduate status. One course. *Costanzo*

218S. Personality, Stress, and Disease (H, P). (SS) The interaction between person and social environment as a contributor to development of physical disease. Both epidemiological and laboratory-based research considered. Prerequisite: Psychology 109, consent of instructor, or graduate status. One course. *Williams*

219S. Physiological Foundations of Psychology (B, P). (NS) Structure and function of the nervous system as related to problems of sensory-motor processes, learning, motivation, and memory. Prerequisite: consent of instructor or graduate status. One course. *C. Erickson and R. Erickson*

220S. Psycholinguistics (C). (SS) Selected topics such as neurolinguistics, linguistic versus pictorial representation, individual differences, oral versus written expression, language and personality, and the language-thought interaction. Prerequisites: Psychology 134 and consent of instructor or graduate status. C-L: Linguistics. One course. *Day*

227S. Behavioral Physiology: Basic Systems (H, P). (SS) Organ systems review of physiology, emphasizing the role of the central nervous system and behavior in physiological function. Prerequisites: for undergraduates—consent of instructor and Psychology 103 or 159S. One course. *Surwit*

228S. Behavioral Physiology: Stress and Disease (H, P). (SS) Physiological processes involved in stress and coping; effects on nervous, cardiovascular, immune, and endocrine systems; how stress influences various disorders, that is, depression, cardiovascular disease, and diabetes. Prerequisites: for undergraduates—consent of instructor; Psychology 121, 159S, and 227S. One course. *Surwit*

230S. Social Behavior of Animals (B, D, P). (NS) Developmental, ecological, and physiological aspects of territorial, sexual, parental, and aggressive behavior. Consent of instructor required. One course. *C. Erickson*

234S. Advanced Personality (P). (SS) Selected topics of current interest concerning empirical research on personality. Strategies for the definition of research questions and the evaluation of research progress. Prerequisite: consent of instructor or graduate status. One course. *M. Wallach*

255S-256S. Life-Span Development I and II. (SS) Behavioral and psychological development. 255S: the origins and course of cognitive and emotional development (including language, memory, achievement, affective regulation of behavioral process). 256S: components of personality and social development (including attachment relations, self esteem, social interactive process, moral development). Broad issues in the interrelationships of environmental context and individual phenomenon in the emergence of these processes. Longitudinal and cross-sectional approaches to the empirical examination of life course phenomenon. Applications to models of both normative and pathological development. Two courses. *Costanzo and staff*

270S, A-R, U-Z. Selected Problems. New courses not yet in the bulletin are designated as 170S or 270S depending on level. Since all faculty offer these courses, their contents vary accordingly. Different courses indicated by the letter. One course. *Staff*

273. Statistics I (G). (SS) Foundations of probability and statistical inference. Introduction to the general linear model via multiple regression. Emphasis on application via statistical computing with SAS. Prerequisites: for undergraduates—consent of instructor and Psychology 117 or equivalent. One course. *Terry*

274. Statistics II (G). (SS) Basic and advanced ANOVA models via the GLM. Broad-based overview of multivariate models, including MANOVA, canonical correlation, discriminant analysis, and factor analytic models. Emphasis on application and use of computer packages. Prerequisites: for undergraduates—consent of instructor; Psychology 117 or equivalent and Psychology 273. One course. *Terry*

COURSES CURRENTLY UNSCHEDULED

113. Research Methods in Psychology (B, C). (SS)

151S. Child Clinical Psychology (D, H, P). (SS)

161S. Advanced Learning Theory (C). (SS)

163S. Stress and Coping (H, P). (SS)

172S. Pain: Coping and Adaptation (H). (SS)

203S. Sensation and Perception (C). (SS)

207S. Topics in Psychobiology (B, H). (NS)

222. Behavioral and Neural Modeling (B). (NS)

266S. Comparative Neurobiology (B). (NS)

289S. Psychology of Prevention (P). (SS)

THE MAJOR

For the A.B. Degree

Corequisites. Corequisites are intended to place the study of psychology into a broad, liberal arts context. They are in four areas; one of a short list of courses is required in each area. (Note: the lists are updated regularly; inquire in the Undergraduate Studies Office).

(1) *Biological context of behavior.* Biology 19, 21L, 22L, or 74L.

(2) *Social context of behavior.* Biological Anthropology and Anatomy 93 or 93D; Cultural Anthropology 94, 100, 119; Sociology 110.

(3) *History/philosophy of science.* Philosophy 104, 109, 110, 111, or 112; Sociology 156; History 157A, B, or C.

(4) *Quantitative methods.* Mathematics 31 or equivalent.

Required Courses. Eight courses in psychology are required for the major, which is devised to provide depth and breadth, a small group course in psychology, and familiarity with the quantitative methods involved in psychology. For breadth, the student is required to take two Introductory and Survey courses including: (1) either 103 (Biological Bases of Behavior) or 107 (Cognitive Psychology), and (2) either 105 (Developmental Psychology), 108 (Personality and Social Behavior), or 109 (Health Psychology). These Introductory and Survey courses define five areas of concentration in psychology as listed above. For depth, the student is required to take at least two courses in one of these areas in addition to the introductory course in that area of concentration. For instruction in small groups, the student is to take at least one seminar (number 140S and above, including 200-level courses). It is advisable that this seminar be in the student's area of concentration. For quantitative methods, the student is to take one of the following: Mathematics 136; Sociology 133; Statistics 100, 110, 112, 200, 210, 213; or Psychology 117 (none of which count as one of the eight required courses in psychology). For purposes of the major, Sociology 106 is the equivalent of Psychology 116, and Sociology 133 is the equivalent of Psychology 117. A student guidebook describing the curriculum in detail is available from the Director of Undergraduate Studies. No course can be used to meet the major requirements in both psychology and also in another

department. Of the eight psychology courses required for the major at least six must be taken in the department at Duke; others, if approved, may count toward the 34 credits needed for graduation.

For the B.S. Degree

As for the A.B. degree, with the following additions: (1) Mathematics 32 or equivalent; (2) six NS courses in at least two of the following (mathematics/natural science) departments: mathematics (100-level or above, in addition to the statistics requirement, above), computer science (100-level or above), chemistry, physics, biological anthropology and anatomy, and biology; (3) at least three of the six mathematics/natural science courses must be numbered 100 or higher; (4) at least one course that involves extensive laboratory or fieldwork (for example, experimental methods or independent research). **Neurosciences Concentration within B.S. Degree**

Students completing a B.S. in psychology may elect to fulfill the requirements for a specialized concentration in neuroscience within the psychology major. Completion of that concentration would be indicated on the official transcript. For information contact the office of the Neuroscience Program and the Director of Undergraduate Studies in psychology.

Independent Study

A program of individualized readings or an empirical research project may be carried out by arrangement with a faculty supervisor and enrollment in Psychology 191-194. A written plan of the program must be approved by the supervisor and the Director of Undergraduate Studies. Credit for 191-194 may be recorded either as pass/fail or by means of letter grades. At most only one of these independent study courses may count toward the area of concentration requirement, and only two may count toward the major.

Honors/Distinction

Any psychology major with an overall grade point average of 3.3 and a grade point average of 3.3 in psychology courses may be a candidate for graduation with distinction in psychology and for university honors by honors project. Students qualify for and are awarded both honors together. Recommendation for these combined honors is made by a three-member faculty committee which evaluates a thesis submitted by the candidate and administers an oral examination. The thesis is expected to be in the style of a publishable article in a psychological journal. Candidates typically enroll in independent study courses (191-194) during one or more semesters, often as early as the junior year, but enrollment in independent study is not required.

Students who wish to be considered for these honors must secure the sponsorship of a psychology department faculty member, and apply to the Director of Undergraduate Studies no later than the time of preregistration for the fall semester of the senior year. Grade point requirements must be met at the time of application, and must be maintained thereafter. Guidelines, including deadlines and application forms, are available from the undergraduate studies office. Students are urged to review these guidelines early in their academic careers.

Public Policy Studies (PPS)

Professor Kuniholm, *Chair*; Assistant Professor Smith, *Director of Undergraduate Studies*; Professors Ascher, Barber (political science), Behn, Clotfelter, Cook, Fleishman (law), Garson (pediatrics and medicine), Gillis, Healy (environment), Hough (political science), Ladd, Magat (business), Pearsall (engineering), and Price (political science); Associate Professors Conrad, Leitzel, Lipscomb, McConahay, and Rapaport; Assistant Professors Gentry (economics), Hamilton, Mayer, Miranda, and Sprinkle (health policy

and pediatrics); Professors of the Practice Boothby, Harris, and Stubbing; Assistant Research Professors Malson and Slawson; Visiting Professor Grummon; Visiting Assistant Professors Korstad, Miller, Ramachandran, and Williams; Visiting Professor of the Practice Geller; Adjunct Associate Professor Arcia; Senior Research Scientist Vaupel; Lecturer Payne; Visiting Lecturers Bates, Bovbjerg, A. Brown, B. Brown, Devine, Eudy, Fulton, Henderson-James, Lampert, O'Dor, Prak, Prato, Probst, Reichert, Reid, Rosenberg, Stevens, and Yeoman

A major is available in this department.

Courses in public policy are open to all students providing that any prerequisites are met.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

55D. Introduction to Policy Analysis. (SS) Basic concepts of analytical thinking including quantitative methods for assessing the probabilities of outcomes and appraising policy alternatives. Illustrated by problems faced by busy decision makers in government, business, law, medicine. One course. *Hamilton, Leitzel, Lipscomb, or Mayer*

81. Essentials of Public Speaking. Basics of and practice in oral presentations, with particular attention to the gathering and organization of speech materials. Preference given to freshmen and sophomores. Does not apply toward Public Policy Studies major. Consent of instructor required. One course. *Hill or O'Dor*

82. Essentials of Public Speaking. Similar to Public Policy Studies 81, but for juniors and seniors. Not open to students who have taken Drama 81 or 82, or Public Policy Studies 81. Does not apply toward Public Policy Studies major. One course. *Hill or O'Dor*

83S. Argumentation. Analysis, investigation, evidence, reasoning and refutation, and other communication strategies. Consent of instructor required. Does not apply toward Public Policy Studies major. One course. *O'Dor*

107. Comparative Environmental Policies. (SS) See C-L: Political Science 107; also C-L: Comparative Area Studies. One course. *McKean*

110. Economic Analysis for Public Policy-Making: Microeconomic and Non-probabilistic Models. (SS) Application of microeconomic analysis to public policy areas, including agriculture, housing, taxation, and income redistribution. (Not open to students who have taken Economics 149.) Prerequisite: Economics 52D or equivalent. One course. *Clotfelter, Conrad, Cook, Ladd, Leitzel, Lipscomb, or Miranda*

112. Statistics and Public Policy. (QR) Uses and limitations of statistical methods, including experimentation, for monitoring and evaluating public policies. Not open to students who have taken Political Science 138, Statistics 10D, or Statistics 110A, or Statistics 110B. Prerequisite: Public Policy Studies 55D. One course. *Cook, Leitzel, McConahay, or Miranda*

114. Political Analysis for Public Policy-Making. (SS) Analysis of the political and organizational processes which influence the formulation and implementation of public policy. Alternative models. Prerequisite: Political Science 90A, 91, 101, or equivalent. C-L: Political Science 145. One course. *Ascher, Hamilton, Mayer, Miller, or Smith*

116. Policy Choice as Value Conflict. (SS) Theoretical and practical problems in decision making in relation to conflicts of value and of interest. The manifestation of norms deriving from professional ethics, ideology, law, and other sources in such policy issues as welfare, environmental management, and national defense. One course. *Korstad, Malson, Payne, or Rapaport*

130S. Democracy and Community in the Welfare State. (SS) The role of community organizations in political advocacy, citizen representation, and social welfare policy. C-L: Political Science 130S. One course. *Smith*

145D. Leadership, Policy, and Change. (SS) Ethical and practical problems of leadership, including motivation, organizational morale, and strategies for large-scale change. Historical and modern case studies, literary examples, and political and psychological theory. One course. *Boothby or Payne*

146S. Leadership and Judgment. (SS) Theoretical and experiential foundation for the exercise of judgment and leadership in policy-making. Readings, in-class exercises, and a major leadership project within either the Duke or Durham community. Consent of instructor required. One course. *Staff*

147. International Environmental Politics and Policies. (SS) See C-L: Political Science 147; also C-L: Comparative Area Studies. One course. *McKean or Miranda*

148S. Environmental Policy, Summer Internship. (SS) Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 149S. Variable credit. *Staff*

149S. United States Environmental Policy. (SS) An overview of the major environmental legislation in the United States. Topics include: air and water pollution, hazardous waste, agriculture, wildlife, and institutions. Political, economic, ethical, and scientific analysis. One course. *Miranda*

151. Administration of Justice. (SS) Analysis of policy problems and conflicts involved in the operation of the criminal justice system. One course. *Devine or Slawson*

152S. Administration of Justice, Summer Internship. (SS) Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 151S. Variable credit. *Staff*

154S. Free Press and Public Policy. (SS) Policy problems and conflicts involved in applying First Amendment principles to print and electronic journalism. Topics include libel, obscenity, privacy, national security, fair trial, and antitrust. C-L: Film and Video. One course. *Stevens*

155S. Journalism and Public Policy, Summer Internship. (SS) Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 154S. Variable credit. *Staff*

157S. Health Policy. (SS) Analysis of health care problems and policies. One course. *Garson or Henderson-James*

158S. Health Policy, Summer Internship. (SS) Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 157S. Variable credit. *Staff*

159. State and Local Public Policy. (SS) How state and local governments pay for public services. Financing education and transportation programs, the use of municipal bonds for capital projects, the design of intergovernmental aid programs, and state and local tax policy. Consent of instructor required. One course. *Ladd or Smith*

160. Nonrenewable Resource Economics and Public Policy. (SS) Microeconomic analysis of nonrenewable resources. Resource scarcity and economic interpretations of doomsday models. Rationale for government intervention into natural resource markets and the effects of governmental policies on investments, rates of extraction, and conservation. Prerequisite: Economics 149. C-L: Economics 160. One course. *Conrad*

161S. State and Local Public Policy, Summer Internship. (SS) Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 159S. Variable credit. *Staff*

163S. Telecommunications Policy and Regulation. (SS) Broadcast policies, the rise of cable television, spectrum allocation and authorization, and developments in common carrier telecommunications. C-L: Film and Video. One course. *Prak*

164S. Telecommunications Policy and Regulation, Summer Internship. (SS) Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 163S. Variable credit. *Staff*

165. American International Economic Policy. (SS) Prerequisites: Economics 1D or 51D and 2D or 2S or 52D. See C-L: Economics 165. One course. *Krueger*

167. International Policy. (SS) Relationships among organizations and agencies involved in international political and economic affairs, focusing on selected problems of international policy. Consent of instructor required. One course. *Ascher, Kuniholm, Leitzel, or Mayer*

168S. International Policy, Summer Internship. (SS) Pass/fail grading only. Half course or one course. Prerequisite: Public Policy Studies 167S. Variable credit. *Staff*

175S. The Palestine Problem and United States Public Policy. (CZ) Identification of Arab and Zionist perceptions, alternatives available to American decision makers, interest group pressures on United States policies, historical analysis as a means to improve public policy. C-L: Comparative Area Studies and History 159S. One course. *Kuniholm*

176S. American Communities: A Photographic Approach. (SS) A documentary approach to the study of American communities through individual photographic projects centered around a community of the student's choosing. Consent of instructor required. C-L: Art 118S and Film and Video. One course. *Harris*

177S. Advanced Documentary Photography. (SS) An advanced course for students who have taken Public Policy Studies 176S or have had substantial experience in documentary fieldwork. Students complete an individual photographic project and study important works within the documentary tradition. Prerequisite: Art 118S, Public Policy Studies 176S, or consent of instructor. C-L: Art 119S. One course. *Harris*

179S. Refugees and World Politics. (SS) Examination of refugee issues in the context of domestic and international political environments. Focus on the interplay among political, social, economic, cultural, and psychological phenomena as governments of host countries, international and nongovernmental organizations, and the refugees interact in the context of ongoing crises in Africa, Southeast Asia, Central America, and the United States. C-L: Comparative Area Studies. One course. *Boothby*

180S. Writing for the Media. (SS) Workshop on writing news stories, editorials, and features for the print media. Consent of instructor required. C-L: Film and Video. One course. *Eudy or Reid*

181S. Advanced News Reporting. (SS) Students report, write, and rewrite six in-depth stories during the semester. Assignments designed to explore investigative reporting techniques and the issues that arise in writing longer, more complex stories. Prerequisite: Public Policy Studies 180S or consent of instructor. One course. *Fulton*

185. American Diplomacy from the Kennedy Administration to the Present. (SS) C-L: History 185. One course. *C. Davis or Kuniholm*

188. The Psychology of Political Symbols. (SS) See C-L: Political Science 188. One course. *McConahay*

190. Internship. For students working in a public agency, political campaign, or other policy-oriented group under the supervision of a faculty member. Prior consent of Assistant Director of Internships, Placement, and Alumni and Director of Undergraduate Studies required. Pass/fail grading only. One course. *Staff*

191, 192. Independent Study. Directed reading and research. One course each. *Staff*

193, 194. Independent Study. Directed reading and research for seniors. One course each. *Staff*

195S, 196S. Selected Public Policy Topics. One course each. *Staff*

For Seniors and Graduates

204S. Ethics in Political Life. (SS) See C-L: Political Science 204S. One course. *Spragens*

216S. Economics of Education. (SS) Prerequisite: Economics 149 or Public Policy Studies 110. See C-L: Economics 216S. One course. *Clotfelter*

217. Microeconomics and Public Policy-Making. (SS) Consumption and production theory, welfare economics, theories of collective choice, market structures and regulation, and nonmarket decision making. Not open to students who have taken Public Policy Studies 110. One course. *Clotfelter or Ladd*

218. Macroeconomic Policy. (SS) Survey of macroeconomic theory and analysis of policies designed to reduce unemployment, stimulate economic growth, and stabilize prices. Conventional monetary and fiscal instruments, employment policies, and new policies designed to combat inflation. C-L: Economics 218. One course. *Leitzel*

219. The Politics of the Policy Process. (SS) The formulation of public policies, substantive policies in a variety of contexts from local government to international affairs; the role of legislatures, interest groups, chief executives, and the bureaucracy in defining alternatives and in shaping policy from agenda formulation to implementation. Not open to students who have taken Public Policy Studies 114. C-L: Political Science 248. One course. *Ascher or Mayer*

221. Decision Analysis for Public Policymakers. (SS) Methods for structuring decision dilemmas and decomposing complex problems, assessing the probabilities of uncertain consequences of alternative decisions, appraising the decision maker's preferences for these consequences and for reexamining the decision. Not open to students who have taken Public Policy Studies 55D. One course. *Behn or Leitzel*

222. Statistics and Data Analysis for Policymakers. (QR) Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210B, or 213. See C-L: Statistics 210A. One course. *Staff*

223. Ethics and Policy-Making. (SS) Normative concepts in politics, liberty, justice, and the public interest: historical and philosophical roots, relationship to one another and to American political tradition, and implications for domestic and international problems. Not open to students who have taken Public Policy Studies 116. C-L: Political Science 245. One course. *Rapaport*

231. Quantitative Evaluation Methods. (QR) Problems in quantifying policy target variables such as unemployment, crime, and poverty. Experimental and nonexperimental methods for evaluating the effect of public programs, including topics in experimen-

tal design, regression analysis, and simulation. Prerequisite: Public Policy Studies 222 or equivalent. One course. *Cook or McConahay*

232. Microeconomics: Policy Applications. (SS) Cost benefit analysis of public programs. Public utility regulation, pollution regulation, hospital rate setting, regulation of product safety. Quantitative methods and microeconomic theory for analysis of both normative and positive aspects of economic policy. Prerequisites: Public Policy Studies 110 or 217 or Economics 149 and familiarity with regression analysis or concurrent enrollment in Public Policy Studies 231. C-L: Economics 232. One course. *Conrad or Ladd*

236, 237. Public Management I and II: Managing Public Agencies. (SS) 236: operations management, information and performance, personnel management, public sector marketing. 237: organizational strategy, organizational structure and design, leadership and motivation, labor negotiations. Prerequisite: for 237: Public Policy Studies 236. One course each. *Behn or Yaggy*

238. Public Budgeting and Financial Management. (SS) Fund accounting for government; techniques of financial analysis, including break-even analysis, cost accounting, cash-flow analysis, and capital budgeting; and governmental budgeting, including the budgetary process and reforms, and the budget crunch in the public sector. One course. *Stubbing*

240S. Analyzing the News. (SS) Research seminar on political messages and effects of media. Methods and findings of content analysis, survey research, critical theory, semiology; research project integrating these approaches. C-L: Film and Video and Political Science 208S. One course. *Paletz*

241. Reporting the American People. (SS) Critical analysis of the sources of information the media rely upon in reporting opinion and policy preferences: opinion polls, bellwethers, informed elites. Includes the design and execution of a public opinion poll on a topic of local or national interest. One course. *McConahay*

245S. Leadership Tutorial. (SS) Analysis of techniques, personal qualities, and organizational factors that help or hinder effective leadership. Practical experience in evaluation of leadership efforts. Prerequisite: Public Policy Studies 145D or consent of instructor. One course. *Boothby or Payne*

250S. Policy, Philanthropy, and the Arts. (SS) Democratic and aesthetic values in relation to past and present patterns of public, corporate, and philanthropic support for the arts. The uses of art criticism and political theory in evaluating subsidies, grants, tax incentives, and censorship. One course. *Payne*

251S. Regulation of Vice and Substance Abuse. (SS) Focus on activities that have traditionally been defined as vices (including drinking, smoking, use of opiates, gambling, pornography, prostitution) and the problems of regulating and controlling them in a free society. Evaluation of social costs and benefits of various alternative policy interventions. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Economics 251S. One course. *Cook*

252S. United States Strategic Arms Policy. (SS) Defense, nuclear and conventional force issues since World War II, the workings of the defense establishment, and the impact of the end of the Cold War. Not open to students who have taken Public Policy Studies 264S.18. One course. *Stubbing*

253. The Politics of Health Care. (SS) The history, status, and future of health care policy. Grounded in political theories such as distributive justice, altruism, and contractarianism. Focus on policy formation. Case discussions of American reform controversies in light of international experience. One course. *Sprinkle*

255. Health Policy Analysis. (SS) Group analysis of a current health-policy problem. Project involves background research, data acquisition, analysis, writing, and presentation of a substantial policy report. Designed for candidates seeking the undergraduate certificate in health policy. Consent of instructor required. One course. *Staff*

256. The Economics of Health Care. (SS) The health care industry and government policies designed to alter market demand and supply relationships: national health insurance, the relationship between insurance, supply constraints, and inflation; the supply and distribution of health manpower; hospital cost containment policy. Prerequisite: Economics 149 or the equivalent or consent of instructor. One course. *Lipscomb*

257. United States Policy in the Middle East. (SS) From World War II to the present with a focus on current policy options. C-L: Comparative Area Studies. One course. *Kuniholm*

259S. State and Local Public Finance. (SS) Analysis of state and local revenue sources, intergovernmental fiscal relations, budgets and expenditures, fiscal aspects of economic development, and the municipal bond market. Policy topics include financing schools and transportation systems, tax policy, and current fiscal issues. Prerequisite: Public Policy Studies 217 or equivalent. C-L: Economics 259S. One course. *Ladd*

260. Economic Policy Analysis of Nonrenewable Resources. (SS) Economic analysis of nonrenewable resources, development, and exploration. Relationship between natural resources and other economic sectors. Emphasis on public policy tax and regulatory policy, natural resources in developing economies and foreign investment in the mining sector. Prerequisite: Economics 149, Public Policy Studies 110, or Public Policy Studies 232. C-L: Economics 260. One course. *Conrad*

261. Evaluation of Public Expenditures. (SS) Basic development of cost benefit analysis from alternative points of view, for example, equity debt, and economy as a whole. Techniques include: construction of cash flows, alternative investment rules, inflation adjustments, optimal timing and duration of projects, private and social pricing. Adjustments for economic distortions, foreign exchange adjustments, risk and income distribution examined in the context of present value rules. Examples and cases from both developed and developing countries. C-L: Economics 261 and Environment 272. One course. *Conrad*

262S. Seminar in Applied Project Evaluation. (SS) Initiate, develop, and perform a project evaluation. Range of topics include measuring the social cost of deforestation, the B1 Bomber, a child nutrition program, the local arts program. Prerequisite: Economics 285 or Public Policy Studies 261. C-L: Economics 262S. One course. *Conrad*

264S. Research Seminar: Topics in Public Policy I. (SS) Selected topics. One course. *Staff*

265S. The Process of International Negotiation. (SS) Negotiations between governments or between international institutions and governments. Explorations of historic cases, such as the U.S.-Canada Free Trade Negotiation, the INF Talks, and Camp David Summit. C-L: Canadian Studies and Political Science 265S. One course. *Mayer*

266S. Comparative Social Policy. (SS) An emphasis on advanced industrial countries. The seminar will explore the relationship between political process and public policy by making cross-national comparisons; introduce the major policy questions in the field of social policy; and provide students with some knowledge of the substance of social policy in different countries. C-L: Comparative Area Studies and Political Science 266S. One course. *Smith*

267S. Policy-Making in International Organizations. (SS) Emphasis on international financial institutions such as the World Bank and the International Monetary Fund. C-L: Political Science 267S. One course. *Ascher*

269. The Regulatory Process. (SS) The utility of contending theories of the regulatory process in explaining regulatory outcomes and of the normative explanations for regulation (for example, public goods, natural monopolies). Analysis of how regulations actually emerge from the interaction of the public, interest groups, executive, legislature, and judiciary. C-L: Political Science 268. One course. *Hamilton*

270S. Humanistic Perspectives on Public Policy. (SS) Modes of inquiry into aspects of social life important to policymakers but beyond the normal reach of social science. Readings from James Agee, Robert Coles, Eudora Welty, James Baldwin, George Eliot, and others. Consent of instructor required. One course. *Payne*

271S. Schools and Social Policy. (SS) Public schools as instruments of public policy. Economic and statistical analysis of the educational production process. Consideration of alternative school reforms. One course. *Clotfelter*

272L. Resource and Environmental Economics. (SS) The application of economic concepts to private- and public-sector decision making concerning natural and environmental resources. Intertemporal resource allocation, benefit-cost analysis, valuation of environmental goods and policy concepts. Includes laboratory. Prerequisite: introductory course in economics. C-L: Environment 270L. One course. *Kramer*

274. Resource and Environmental Policy. (SS) Development of a policy analysis framework for studying resource and environmental policy. Political institutions, interest group theory, public choice theory, role of economics in policy analysis, ethics and values. Application to current and historical U.S. policy issues. Prerequisite: Environment 270L, Public Policy Studies 272, or consent of instructor. C-L: Environment 274. One course. *Healy and Morton*

278. Human Service Bureaucracies. (SS) Schools, prisons, courts, welfare agencies: decision making, implementation, the impact of work practices on clients. The future of street-level bureaucracy. C-L: Women's Studies. One course. *Malson*

283S. Congressional Policy-Making. (SS) See C-L: Political Science 283S. One course. *Bianco*

284S. Public Policy Process in Developing Countries. (SS) Policy-making patterns in less developed countries; examples from Latin America, Africa, and Asia. C-L: Comparative Area Studies and Political Science 284S. One course. *Ascher*

285. Land Use Principles and Policy. (SS) Consideration of four major roles of land in the United States: as a producer of commodities, financial asset, component of environmental systems, and location of development. Analysis of market allocation of land, market failure, role of public planning and regulation. C-L: Environment 285. One course. *Healy*

286S. Economic Policy-Making in Developing Countries. (SS) Fiscal, monetary, and exchange rate policies in less developed countries; issues in public policy toward natural resources and state-owned enterprises. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Comparative Area Studies and Economics 286S. One course. *Conrad, Gillis, or Ramachandran*

290. Glasgow Seminar in Public Policy. (SS) Analysis of the British political system and important public policy problems in Britain including: privatization, Britain and the European community, and economic and social policy. (Taught in Scotland.) Prereq-

quisites: Public Policy Studies 55D, three of the core courses (PPS 110, 112, 114 or 116) and consent of Director of Undergraduate Studies. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

- 118S. Ethical Dilemmas and Social Policy. (SS)
- 166. Child Policy in the United States. (SS)
- 178S. Visual Language and Policy Choice. (SS)
- 186S. Shaping the News. (SS)
- 254. Transportation Planning and Policy Analysis. (SS)
- 263S. Economics and International Security Policy. (SS)
- 268. Federal Tax Policy. (SS)

INTERNSHIP COURSES

The internship courses provide students with an opportunity to develop a basic understanding of one or more public policy areas, to apply that understanding in a job during the summer, and to return to the classroom to build on this knowledge and experience. Normally, students take a pre-internship course during the spring semester of their junior year as one of several substantive courses including international policy, telecommunications policy, health policy, administration of justice, state and local policy, environmental policy, and journalism and public policy. Students then follow up their pre-internship course with a summer internship in Washington or Durham. Independent internships are also possible.

In order to participate in the summer internship, all majors must have completed Public Policy Studies 55D and three of the four core courses (Public Policy Studies 110, 112, 114, or 116). This requirement may be waived by the Director of Undergraduate Studies for transfer students or others in unusual circumstances. Applications for enrollment in the internship program must be completed in the early fall and approved by the Assistant Director of Internships, Placement, and Alumni.

Stipends are usually provided for all public policy studies majors enrolled in a pre-internship course and any one of the following summer courses: Public Policy Studies 148S, 152S, 155S, 158S, 161S, 164S, or 168S. All majors are encouraged to take an advanced follow-up course in the area of their summer internship.

THE MAJOR

The public policy studies major is an interdisciplinary social science program designed to provide students with the skills, analytical perspectives, and descriptive information needed to deal effectively with major contemporary social problems. The course of study familiarizes the student with the kind of contribution each of several disciplines (political science, economics, social psychology, applied mathematics, history, and ethics) can make to one's understanding of contemporary policy issues such as air pollution, crime, and international trade disputes. Opportunities are provided, both in the classroom and through field experiences, for students to integrate this material and apply it to analyzing specific public policy issues.

Students majoring in public policy participate in a variety of learning experiences including seminars, lecture and discussion classes, individual study, policy workshops, and an internship. In addition, students are urged to participate actively in programs sponsored by the Sanford Institute of Public Policy to supplement material covered in class. As a matter of policy, students are asked to evaluate teaching and course content and are provided both formal and informal opportunities to shape the program and curriculum.

Prerequisites. Economics 2D or 52D, Political Science 90A or 91, and Public Policy Studies 55D.

Major Requirements. Public Policy Studies 110, 112, 114, 116, plus three 100/200-level elective courses; one of these must be a 200-level course. (Statistics 10D or Statistics 110A or Political Science 138 is an acceptable substitute for Public Policy Studies 112.) A policy-oriented field experience approved by the Assistant Director of Internships, Placement, and Alumni is required. (See Internship Courses above.)

Religion (REL)

Professor Hillerbrand, *Chair*; Associate Professor McCollough, *Director of Undergraduate Studies*; Professors Clark, Kort, Lawrence, Lincoln, C. Meyers, E. Meyers, Osborn, Sanders, and Wintermute; Associate Professors Bland, Corless, Partin, Peters, and Surin; Assistant Professors Cornell and Martin; Lecturer Shows

A major is available in this department.

Study in the Department of Religion arises from the recognition that religion, although it takes many forms, is a constitutive element of human existence individually and collectively. The curriculum pursues the study of religion in two distinguishable ways: first, through the examination of the particulars of specific religious traditions; and, second, through theoretical studies of an analytic, comparative, and constructive nature.

Introductory courses (Religion 50, 51, 52, 53, 54, 55, 57, 58, 59, and 61) are open to all undergraduates. These courses also help fulfill distributional field requirements for the religion major. Courses at the 100 level, with the exception of those specially designated, are open to all undergraduates. Courses at the 200 level are open to upperclassmen with the consent of the instructor.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

50. The Old Testament. (CZ) Historical, literary, and theological investigations. C-L: Judaic Studies. One course. *C. Meyers, E. Meyers, Peters, or Wintermute*

51. Introduction to Judaic Civilization. (CZ) Continuity and change in the major periods of Judaism. C-L: History 51 and Judaic Studies. One course. *Bland or E. Meyers*

52. The New Testament. (CZ) Origins, development, and content of thought. One course. *Martin, Sanders, or staff*

53. The Roman Catholic Tradition. (CZ) A survey of the development of Roman Catholic theology and institutions from the second century to Vatican II. One course. *Clark*

54. Protestant Traditions. (CZ) A survey of the historical development of Protestant theologies and denominations. One course. *Clark or Hillerbrand*

55. Biblical Literature. (AL) A study of selected Old Testament and New Testament texts, their cultural context, and the relation within them of religious meaning to literary form. One course. *Staff*

57. Introduction to Religions of Asia. (CZ) Problems and methods in the study of religion, followed by a survey of the historical development, beliefs, practices, and contemporary significance of the Islamic religion and religions of south and east Asia. C-L: Comparative Area Studies. One course. *Corless, Cornell, Lawrence, or Partin*

58. Interpretations of Religion in Western Culture. (CZ) Western religion as explained by contemporary sociologists, psychologists, anthropologists, and theologians. One course. *Bland or staff*

59. An Introduction to Christian Theology and Ethics. (CZ) Analysis and interpretation of faith and practice. One course. *Kort, McCollough, or Osborn*

60. Ethical Issues in Twentieth-Century America. (CZ) A critical examination of ethical themes, with special emphasis on public policy. For participants in the Twentieth-Century America FOCUS Program only. One course. *McCollough*

61. Introduction to Religions of the West. (CZ) Judaism, Christianity, and Islam in their historical and cultural contexts, with their precursors and successors. One course. *Corless*

72A. Seminar for First- and Second-Year Students: African and Asian Traditions. (CZ) Topics and instructors to be announced. One course. *Staff*

72C. Seminar for First- and Second-Year Students: Analytic, Comparative, and Constructive Studies. (CZ) Topics and instructors to be announced. One course. *Staff*

99. Perspectives in Archaeology. (CZ) Major trends and issues in archaeology, literature and material culture, history and process, and applications of archaeology to modern society. Focus on the material remains of the past and traditional and modern methods of their analysis. May be offered abroad in Duke's Summer Program in Israel or Greece. C-L: Classical Studies 99, Interdisciplinary Course 99, and Judaic Studies. One course. *C. Meyers, E. Meyers, Younger, and staff*

101. Selected Studies in the Bible: Prophets. (CZ) Analysis and interpretation of representative issues and personalities in the historical and prophetic books. C-L: Judaic Studies. One course. *Staff*

103. Islam on the Pacific Rim. (CZ) The development of Islam and Islamic civilization in Southeast and Eastern Asia from the rise of Islam to modern times. One course. *Cornell*

104. Apocalypse Then and Now: Ancient and Modern Apocalypticism. (CZ) An interdisciplinary examination of ancient Jewish and Christian apocalypticism combined with study of occurrences of apocalyptic images and themes in modern fiction, politics, art, film, and social movements. The various functions of apocalyptic in ancient and modern cultures and conflicts. One course. *Martin*

105. Theology of the Old Testament. (CZ) Emphasis upon history and eschatology, covenant, messianism, and wisdom. C-L: Judaic Studies. One course. *Wintermute*

106. Jesus and the Synoptic Gospels. (CZ) The gospel tradition in the New Testament. One course. *Staff*

108. The Life and Letters of Paul. (CZ) Paul's role in the expansion of the Christian movement, the most important aspects of his thought, and his continuing influence. One course. *Martin or Sanders*

109. Women in the Biblical Tradition: Image and Role. (CZ) C-L: Judaic Studies and Women's Studies. One course. *C. Meyers*

110. Archaeology and Art of the Biblical World. (CZ) The material culture of ancient Palestine as it relates to the Hebrew Bible, the New Testament, and early Judaism. C-L: Comparative Area Studies and Judaic Studies. One course. *C. Meyers or E. Meyers*

111. The Historical Jesus. (CZ) Historical research on the life of Jesus. One course. *Martin or Sanders*

115-116. Introduction to Biblical Hebrew. (FL) (Divinity School courses open to undergraduates with consent of instructor.) Elements of phonology, morphology, and

syntax. Exercises in reading and writing Hebrew. 116: study of the weak verb; exegetical treatment of the Book of Jonah. C-L: Judaic Studies. Two courses. *Bailey*

120. History of the Christian Church. (CZ) Crucial events, issues, structures, and writings that have shaped the Christian community and influenced Western civilization from the time of the early church to the present. One course. *Hillerbrand*

121. Strategies of Comparative Analysis. (SS) See C-L: Comparative Area Studies 125; also C-L: Cultural Anthropology 125, History 137, Political Science 125, and Sociology 125. One course. *Staff*

122. The Age of the Reformation. (CZ) Religious change and political consolidation in Europe: 1500-1650. One course. *Hillerbrand*

124. Christianity in the United States. (CZ) Leaders and issues in representative movements and institutions. One course. *Staff*

125. Women and Sexuality in the Christian Tradition. (CZ) A historical survey of Christian attitudes and practices from New Testament times to the present. C-L: Comparative Area Studies and Women's Studies. One course. *Clark*

126. Russian Orthodoxy. (CZ) See C-L: Russian 129. One course. *Pelech*

128. Christians in Crisis. (CZ) Christian thought and debate on, and theological analysis of, such contemporary issues as abortion, creationism, homosexuality, liberation, poverty, racism, and sexism. One course. *Osborn*

129. Contemporary Christian Faith and Politics. (CZ) One course. *Osborn*

130. Late Antique Christian Art. (AL) See C-L: Art 130; also C-L: Classical Studies 130. One course. *Wharton*

133. The Foundations of Post-Biblical Judaism. (CZ) History, religion, and literature of Pharisaic and sectarian Judaism from the time of Ezra to Rabbi Judah. C-L: Judaic Studies. One course. *E. Meyers*

134. Jewish Mysticism. (CZ) The main historical stages, personalities, texts, and doctrines from rabbinic to modern times. C-L: Comparative Area Studies, Judaic Studies, and Medieval and Renaissance Studies. One course. *Bland*

135. Jewish Religious Thought. (CZ) Doctrines, dialectics, and religious attitudes of pre-Enlightenment theologians. C-L: Comparative Area Studies, Judaic Studies, and Medieval and Renaissance Studies. One course. *Bland*

136. Contemporary Jewish Thought. (CZ) Modern Jewish thought from Mendelssohn to the present, with particular reference to American thinkers. C-L: Comparative Area Studies and Judaic Studies. One course. *Bland or E. Meyers*

137. An Introduction to Judaism in the Greco-Roman World. (CZ) History, religion, and literature of the Jews in Palestine from 200 B.C.E. to 66 C.E. Not open to students who have taken Religion 277. One course. *Sanders*

140. Religions of India. (CZ) Major religious traditions of the subcontinent: Hinduism, Buddhism, Jainism, and Islam. C-L: Comparative Area Studies. One course. *Lawrence or staff*

141. Religions of China and Japan. (CZ) Traditional religion in China and Japan and its interaction with Sino-Japanese Buddhism. C-L: Comparative Area Studies. One course. *Corless*

143. Mysticism. (CZ) The mystical element of religion: Hinduism, Buddhism, Christianity, and Islam. C-L: Comparative Area Studies. One course. *Staff*

148. Modern American Religious Cults. (CZ) New or alternative religious groups such as the Moonies, Hare Krishnas, Wicca, Satanism, Scientology, TM, Eckankar, UFO cults, and the New Age Movement. One course. *Partin*

149. Buddha and Buddhism. (CZ) A systematic introduction to the origins and spread of Buddhist thought and practice. C-L: Comparative Area Studies. One course. *Corless*

151. Ethical Issues in Social Change and Public Policy. (CZ) American moral tradition and factors in social change in the normative analysis of public policy, with a consideration of specific ethical issues. One course. *McCollough*

152. Islamic Mysticism. (CZ) Sufism as an ascetical protest movement that affected the worldwide growth of Islam. C-L: Comparative Area Studies. One course. *Lawrence*

153. From the African Kraal to the African-American Church. (CZ) The religious transition and adaptation of the West African Diaspora in America. C-L: African and Afro-American Studies 153. One course. *Lincoln*

154. Cult, Sect, and Church in Black Religion in America. (CZ) The varied expressions of African-American spirituality as the black church matures as the preeminent definition of African-American Culture. C-L: African and Afro-American Studies 152. One course. *Lincoln*

155. Ethical Issues in the Life Cycle. (CZ) Human development viewed in religious, ethical, and psychological perspectives. One course. *McCollough*

158. Psychology and Religion. (SS) Contributions of major psychological theories to an understanding of religion, especially Christianity. One course. *Shows*

159. Ethical Issues in Health Care. (CZ) A theological and comparative study of selected ethical issues in health policy: the profession of medicine, institutional organization and services, and medical practice. One course. *McCollough*

160, 161. Introduction to the Civilizations of Southern Asia. (CZ) See C-L: Interdisciplinary Course 101, 102; also C-L: Asian and African Languages and Literature 160, 161; Comparative Area Studies; Cultural Anthropology 101, 102; and History 193, 194. One course each. *Khanna or staff*

162, 163. Introduction to Islamic Civilization. (CZ) See C-L: Interdisciplinary Course 162, 163; also C-L: Comparative Area Studies; Cultural Anthropology 147, 148; History 101G, 102G; and Medieval and Renaissance Studies. One course each. *Cornell, Lawrence, and staff*

164. History and Religions of North Africa. (CZ) An introduction to the cultural patterns, social forces, and historical developments that have shaped North Africa and its major religious traditions. C-L: African and Afro-American Studies 164, Comparative Area Studies, History 187, and Interdisciplinary Course 164. One course. *Cornell or Lawrence*

167. The Reformation of the Sixteenth Century. (CZ) A survey of the changes in sixteenth-century European society, with particular reference to the continent, which grew out of the movement for religious reform and renewal. Focus on new developments in theology and religion and their relationship to society. C-L: History 156A. One course. *Hillerbrand*

170. Problems of Religious Thought. (CZ) Analysis of uses of *know, true, mind, body, time, person, love, meaning*, in modern Western culture as introduction to religious reflection. One course. *Staff*

174. Technology Assessment and Social Choice. (CZ) See C-L: Engineering 174. One course. *Garg and McCollough*

186. Faith and Fiction in Victorian England. (AL) The relation of fiction to major religious and theological developments in England during the Victorian period. (Summer program in England.) Not open to students who have taken English 137. C-L: English 132A. One course. *Staff*

187. Atmosphere and Mystery in Twentieth-Century English Fiction. (AL) Narrative atmosphere in English fiction of this century in relation to beliefs about circumstances that limit and determine the human world. Not open to students who have taken English 138. C-L: English 132B. One course. *Kort*

188. Religion in Recent American Fiction. (AL) Religious elements in recent literature. One course. *Kort*

189. Autobiography and Religious Identity. (CZ) A study of contemporary autobiographies by Jewish, Catholic, and Protestant writers, of theories concerning autobiography and religious identity, and of autobiography as a kind of writing. One course. *Kort*

190S. The Family in Christian History. (CZ) Open to sophomores, juniors, and seniors. Consent of instructor required. See C-L: Distinguished Professor Course 197S; also C-L: Women's Studies. One course. *Clark*

191, 192. Independent Study. For freshmen and sophomores with departmental approval. One course each. *Staff*

193, 194. Independent Study. For juniors and seniors with departmental approval. One course each. *Staff*

195A, 196A. Junior-Senior Seminars: African and Asian Traditions. (CZ) Topics and instructors to be announced. One course each. *Staff*

195B, 196B. Junior-Senior Seminars: Jewish and Christian Traditions. (CZ) Topics and instructors to be announced. C-L: Judaic Studies. One course each. *Staff*

195C, 196C. Junior-Senior Seminars: Analytic, Comparative, and Constructive Studies. (CZ) Topics and instructors to be announced. One course each. *Staff*

197-198. Honors Research. Consent of the Director of Undergraduate Studies required. Two courses. *Staff*

199S. Religion: Interpretations and Perspectives. (CZ) Approaches and methods used for studying religion. Emphasis on the description, explanation, and analysis of such concepts as religion, religious experience, and religious practice. Prerequisite: two completed courses in religion. One course. *Staff*

For Seniors and Graduates

201. Studies in Intertestamental Literature. (CZ) Selected documents of the Apocrypha and Pseudepigrapha examined exegetically and theologically in their relation to postexilic Judaism. Consent of instructor required. One course. *Wintermute*

202. Language and Literature of Dead Sea Scrolls. (CZ) A study in interpretation. Prerequisite: a knowledge of Hebrew. One course. *Wintermute*

207, 208. Intermediate Biblical Hebrew. (FL) Grammar with reading and exegesis of Old Testament prose and poetry. Prerequisite: at least one year of Hebrew or consent of instructor. C-L: Judaic Studies and Old Testament 207, 208. One course each. *Staff*

216. Syriac. (CZ) The script and grammar, with readings from the Syriac New Testament and other early Christian documents. Prerequisites: some knowledge of Hebrew and Aramaic. One course. *Wintermute*

217. Islam in India. (CZ) History and thought of major Indian Muslims from Biruni to Wali-Ullah, with special attention to the role of Sufism. An introduction to selected Muslim scholars and saints who contributed to the interaction between Islam and Hinduism in northern India during the second millenium A.D. C-L: Comparative Area Studies. One course. *Lawrence*

218. Religions of East Asia. (CZ) Shinto, Taoism, Confucianism, and East Asian Buddhism studied phenomenologically in relation to the Axial Age. C-L: Comparative Area Studies. One course. *Corless*

220. Rabbinic Hebrew. (FL) Interpretive study of late Hebrew, with readings from the Mishnah and Jewish liturgy. C-L: Judaic Studies. One course. *E. Meyers or staff*

221. Readings in Hebrew Biblical Commentaries. (CZ) Selected Hebrew texts in Midrash Aggadah and other Hebrew commentaries reflecting major trends of classical Jewish exegesis. C-L: Judaic Studies. One course. *Bland*

224A. Comparative Semitic I. (FL) An introduction to the morphology and syntax of classical Ethiopic and the Semitic languages of Mesopotamia, together with a consideration of their relationships to Hebrew. One course. *Wintermute*

224B. Comparative Semitic II. (FL) An introduction to the morphology and syntax of classical Arabic and the Semitic languages of Palestine-Syria, together with a consideration of their relationships to Hebrew. One course. *Wintermute*

226F. Exegesis of the Greek New Testament (I and II Corinthians). (CZ) Consent of instructor required. One course. *Staff*

228. Twentieth-Century Continental Theology. (CZ) An investigation of leading theologians and theological trends. One course. *Osborn*

229S. Old Church Slavonic. (FL) See C-L: Russian 203S; also C-L: Linguistics. One course. *Pugh*

231S. Seminar in Religion and Contemporary Thought. (CZ) Analytical reading and discussion of such critical cultural analysis as is found in the works of Polanyi, Arendt, Trilling, and others, with appraisal of the relevance of theological inquiry. One course. *Staff*

232S. Religion and Literary Studies. (AL) Theories concerning the relation of religion to literary forms, particularly narrative. One course. *Kort*

233. Modern Narratives and Religious Meanings. (AL) A study of kinds of religious meaning or significance in representative American, British, and continental fiction of the first half of the twentieth century. One course. *Kort*

234. Early Christian Asceticism. (CZ) The development of asceticism and monasticism in the first six centuries of Christianity. C-L: Women's Studies. One course. *Clark*

235. Heresy: Theological and Social Dimensions of Early Christian Dissent. (CZ) One course. *Clark*

239. Introduction to Middle Egyptian I. (FL) Grammar and readings in hieroglyphic texts relating to the Old Testament. One course. *Wintermute*

240. Introduction to Middle Egyptian II. (FL) Readings in Middle Egyptian and introduction to New Egyptian grammar. Prerequisite: Religion 239. One course. *Wintermute*

243. Archaeology of Palestine in Biblical Times. (CZ) Investigation of selected material remains from the Bronze Age to the Persian period. Trends in biblical studies, with particular attention to methodological considerations and current developments. C-L: Judaic Studies. One course. *C. Meyers*

244. Archaeology of Palestine in Hellenistic-Roman Times. (CZ) The study of material and epigraphic remains as they relate to Judaism in Hellenistic-Roman times, with special emphasis on Jewish art. C-L: Judaic Studies. One course. *E. Meyers*

248. Theology of Karl Barth. (CZ) A historical and critical study of Barth's theology. One course. *Osborn*

253. Feminist Theory and the Study of Christianity. (CZ) Nineteenth- and twentieth-century feminist theories and their implications for Christian doctrine and biblical interpretation. C-L: Women's Studies. One course. *Clark and McClintock-Fulkerson*

254. Justice, Law, and Commerce in Islam. (CZ) Islamic approaches to the legal and ethical regulation of social life. One course. *Cornell*

258. Coptic. (FL) Introduction to the Sahidic dialect with selected readings from Christian and Gnostic texts. Prerequisite: one year of Greek or consent of instructor. One course. *Wintermute*

261. Islam in the African-American Experience. (CZ) The impact of Islam on the religious experiences of African Americans. C-L: African and Afro-American Studies 261. One course. *Lincoln*

264. The Sociology of the Black Church. (SS) An effort to identify, define, describe, and interpret the black church. One course. *Lincoln*

274A. Philosophies, Sciences, and Theologies of the European Enlightenment: Descartes to Kant. (CZ) Western theological thought since the Scientific Revolution, with emphasis on developments and movements that occurred in the seventeenth and eighteenth centuries. Descartes, Locke, Leibniz, Spinoza, Hume, Vico, Lessing, Herder, and Kant. One course. *Surin*

275S. Topics in Early Christian and Byzantine Art. (AL) Consent of instructor required. See C-L: Art 233S; also C-L: Classical Studies 230S and Medieval and Renaissance Studies. One course. *Wharton*

277. Judaism in the Greco-Roman World. (CZ) History, religion, and literature of the Jews in Palestine from 200 B.C.E. to 66 C.E. Not open to students who have taken Religion 137. Prerequisite: one year of Greek. One course. *Sanders*

280. The History of the History of Religions. (CZ) The origin and history of the comparative study of religion, with particular attention to its methodology. One course. *Partin*

284. The Religion and History of Islam. (CZ) Origins and development of the Islamic community and tradition, with particular attention to the religious element. C-L: Comparative Area Studies. One course. *Partin*

297. Philosophical and Theological Discourses on Modernity. (CZ) Theological responses to the intellectual and cultural agendas set by the Enlightenment. One course. *Surin*

298. **Religious Pluralism and Christian Theologies.** (CZ) The ascription of superiority or uniqueness to particular religions within the context of the world religions. The phenomenon of religious pluralism will provide a thematic focus for this study. One course. *Surin*

COURSES CURRENTLY UNSCHEDULED

52D. **The New Testament.** (CZ)

71A. **Seminar for First- and Second-Year Students: African and Asian Traditions.** (CZ)

71B, 72B. **Seminars for First- and Second-Year Students: Jewish and Christian Traditions.** (CZ)

71C. **Seminar for First- and Second-Year Students: Analytic, Comparative, and Constructive Studies.** (CZ)

100. **Selected Studies in the Bible: Pentateuch.** (CZ)

102. **Selected Studies in the Bible: Writings.** (CZ)

107. **Theology of the New Testament.** (AL)

123. **Issues in Early Christian History.** (CZ)

131D. **Principles of Archaeological Investigation.** (CZ)

132D. **Palestine in Late Antiquity.** (CZ)

142. **Comparative Mythology.** (CZ)

145. **Social Issues in Contemporary Hinduism.** (CZ)

147. **Muhammad and the Qur'an.** (CZ)

157. **Bioethics in Comparative Contexts.** (CZ)

166. **The Professions and Society.** (SS)

168. **Religion and Society in Early Modern Europe.** (CZ)

172. **Religion and Tragedy.** (AL)

212. **Policy-Making and Theological Ethics.** (CZ)

226B. **Exegesis of the Greek New Testament (Romans).** (CZ)

230S. **The Meaning of Religious Language.** (CZ)

238. **Jewish Responses to Christianity.** (CZ)

274B. **Philosophies, Sciences, and Theologies after the European Enlightenment: Schleiermacher to Troeltsch.** (CZ)

281. **Phenomenology and Religion.** (CZ)

282. **Myth and Ritual.** (CZ)

283. **Islam and Modernism.** (CZ)

285. **Introduction to the History of Religions.** (CZ)

287. **The Scriptures of Asia.** (CZ)

288. **Buddhist Thought and Practice.** (CZ)

RELIGION COURSES BY FIELDS

Introductory Courses. Religion 50, 51, 52, 52D, 53, 54, 55, 57, 58, 59, 60, 61.

African and Asian Religions. Religion 57, 61, 71A, 72A, 103, 140, 141, 145, 147, 149, 152, 160, 161, 162, 163, 195A, 196A, 217, 254, 255, 283, 284, 285, 287.

Jewish and Christian Traditions. Religion 50, 51, 52, 52D, 53, 54, 55, 71B, 72B, 100, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111, 115-116, 120, 123, 124, 125, 127, 128, 129, 131D, 132D, 134, 135, 136, 137, 139, 189, 195B, 196B, 207, 208, 220, 221, 226B, 228, 239, 243, 248, 258, 277.

Analytic, Comparative, and Constructive Studies. Religion 58, 59, 60, 71C, 72C, 99, 142, 143, 148, 151, 153, 154, 155, 157, 158, 159, 166, 170, 172, 174, 188, 195C, 196C, 212, 233, 238, 261, 264, 280.

THE MAJOR

Major Requirements. Eight courses, which must include at least two introductory courses (numbered 50 through 61). The distribution of courses must also include at least one each from the categories African and Asian traditions; Jewish and Christian traditions; and analytic, comparative, and constructive studies. One of the eight courses must be a junior-senior seminar or a 200-level course.

The student, in consultation with an assigned advisor and with the advisor's approval, should elect four of the eight courses in such a way that they constitute a thematic or methodological concentration on a particular aspect of religion.

To prepare for graduate or professional study of religion, the department recommends that students complete at least four courses in college level study, or the equivalent, of a foreign language. Master of Arts and Doctor of Philosophy programs often require examination in one or two foreign languages. Students planning to attend a theological seminary should note that knowledge of biblical languages, as well as Latin, frequently is presupposed or required. Those planning to pursue studies of Asian religions should begin appropriate language study as part of their undergraduate preparation.

Honors/Distinction. The department offers work leading to graduation with distinction. For further information consult the Director of Undergraduate Studies and the section on honors in this bulletin.

Romance Studies (RS)

Professor Thomas, *Chair*; Associate Professor Bell, *Director of Undergraduate Studies*; Professors Caserta, Garci-Gómez, Jameson, Mignolo, Moi, Mudimbe, Orr, Osuna, Pérez Firmat, Schor, Stewart, and Tetel; Associate Professors Kaplan, Mudimbe-Boyi, Ross, and Sieburth; Assistant Professors Farrell, Finucci, Solterer, and Vilarós; Adjunct Associate Professors Byrd and Keineg; Associate Professor of the Practice and Director of Language Program Tufts; Lecturer and Assistant Coordinator of Language Programs in Spanish Cowell

Majors in Italian Studies, French, and Spanish are available in this department.

French, Italian, and Spanish 22, 76, or an Achievement or Placement Test score of 600 in French, 600 in Italian, and 630 in Spanish, are prerequisites for all courses over 100 not taught in English. Students who by reason of foreign residence have had special opportunities in French, Italian, or Spanish must be classified by the Director of Undergraduate Studies. The intensive language courses 21 and 22 provide an introduction to the language. They are recommended for students who wish to acquire proficiency in a second foreign language before entering graduate school. In literature, one credit is granted for a score of 4 and two credits for a score of 5 (French or Spanish 70, 71) on the examination of the advanced placement program. In language, one advanced placement credit (French or Spanish 76) is granted for scores of 4 and 5.

FRENCH (FR)

1-2. Elementary French. (FL) Understanding, speaking, reading, and writing French. Language laboratory for recording-listening practice. Two courses. *Staff*

12. Review of Elementary French. (FL) Intensive review of first-year French. Open only to students with a placement or achievement score of 380-440. May not be taken for credit by students who have taken 1-2. One course. *Staff*

14. Intensive Study of French. (FL) Understanding, speaking, reading, and writing French. Offered in the Duke in Québec Summer Program. Placement of returning students intending to continue French studies determined by interview. Two courses. *Staff*

21. Intensive Elementary French. (FL) Basic grammar structures in one semester, emphasis on oral work. Prerequisite: four semesters or the equivalent of another foreign language or consent of instructor. One course. *Staff*

22. Intensive Intermediate French. (FL) Review of basic grammar, emphasis on reading, with some practice in writing. Prepares students to enroll in courses at the 100 level. Prerequisite: French 21 or consent of instructor. One course. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

63. Intermediate French. (FL) Grammar review, reading, and oral practice, including laboratory experience. Prerequisite: French 2, 12, or achievement or placement test score of 450-540. One course. *Staff*

70, 71. Introduction to Literature. One or two course credits for advanced placement in literature. One course each.

76. Advanced Intermediate French. (FL) Oral practice, reading, composition. Prerequisite: French 63 or achievement or placement test score of 550-590. One course. *Staff*

101, 102. Introduction to French Literature. (AL, FL) An introduction to the major writers of the French literary tradition. Selections and complete works of poetry, fiction, theater, and essay. 101: Middle Ages through the eighteenth century. 102: nineteenth and twentieth centuries. Lectures and discussions; short essays and tests. Conducted in French. One course each. *Staff*

103S, 104S. Discussions of Readings. (AL, FL) Selected topics. Open only to freshmen and sophomores. One course each. *Staff*

107S. Contemporary Ideas. (CZ, FL) Readings and discussion of French works which have provoked political or intellectual thought in recent years. For freshmen and sophomores only. C-L: Comparative Area Studies. One course. *Staff*

110. Advanced Grammar and Composition. (FL) A systematic study of the structure of formal French. Practice in writing. One course. *Thomas or staff*

111S. French for Current Affairs. (FL) Problems and controversies in today's France. Readings, discussions, and exposés. One course. *Keineg or staff*

113S. French for Business and Law. (FL) An introduction to French commercial and legal practices and vocabulary. C-L: Comparative Area Studies. One course. *Staff*

117. French Phonetics. (FL) Sounds, rhythm, intonation. Individual practice in language laboratory. Readings in phonetic theory. One course. *Thomas*

118. Advanced Translation and Stylistics. (FL) Differences between French and English patterns of expression. Levels of usage. Practice in translation. Prerequisite: French 110 or equivalent or consent of instructor. One course. *Thomas or staff*

131S. French in the New World. (FL, SS) French and Creole in Canada, New England, Louisiana, and the Caribbean. Origins, history, linguistic characteristics, current political and social issues. C-L: Canadian Studies, Comparative Area Studies, and Linguistics. One course. *Thomas*

137. Aspects of Contemporary French Culture. (CZ, FL) Offered only as part of summer program in Paris. C-L: Comparative Area Studies. One course. *Staff*

139. French Civilization. (CZ, FL) The institutions and culture of France from the Middle Ages to the present. Readings and discussions in French. C-L: Comparative Area Studies. One course. *Keineg or Tetel*

141S, 142S. French Literature. (AL, FL) Topics to be announced. Open to juniors and seniors. One course each. *Staff*

143. Aspects of French Literature. (AL, FL) Concentration on single authors, genres, movements, or themes. Topics to be announced. Offered only as part of summer program in Paris. One course. *Staff*

145S. Topics in Renaissance Literature and Culture. (AL, FL) Topics may include: women writers, love and self-knowledge, carnival and the grotesque, in search of Rome, text as political and religious pamphlet. C-L: Comparative Area Studies and Medieval and Renaissance Studies. One course. *Tetel*

146S. Montaigne and Self-Portraiture. (AL, FL) A reading of some *essais* in the light of the self-portrait in Renaissance art. C-L: Medieval and Renaissance Studies. One course. *Tetel*

148. French Drama of the Seventeenth Century. (AL, FL) The plays of Corneille, Racine, and Molière read in conjunction with several twentieth-century works to explore dramatic conventions and the difference between tragedy and comedy. C-L: Drama 126 and Medieval and Renaissance Studies. One course. *Farrell*

151. French Comedy. (AL, FL) The theatrical tradition of comedy and its evolution, with emphasis on Molière, Marivaux, and Beaumarchais, and other readings from *Pathelin* to Ionesco. C-L: Drama 122. One course. *Stewart*

152. The Early French Novel. (AL, FL) Origins and evolution of the novel in the seventeenth and eighteenth centuries: Madame de Lafayette, Marivaux, Prévost, Rousseau, Diderot, Laclos, Sade. One course. *Stewart*

153. The French Enlightenment. (AL, FL) Religion, politics, and philosophic and literary ideas of eighteenth-century France: Montesquieu, Voltaire, Rousseau, and others. C-L: Comparative Area Studies. One course. *Stewart*

156. The Age of the Novel. (AL, FL) Flaubert, Balzac, and Stendhal. One course. *Bell, Orr, or Schor*

158. Toward Modernism in French Poetry. (AL, FL) An introduction to modern trends in the nineteenth century; emergence from traditional romanticism; art for art's sake and Parnassians (Gautier, Leconte de Lisle); the transition from decadence to symbolism (Baudelaire, Verlaine, Rimbaud, and Mallarmé). One course. *Thomas*

159. Feminist Fiction. (AL, FL) Works by women in the modern period, including George Sand, Colette, Simone de Beauvoir, and others. C-L: Women's Studies. One course. *Orr*

162. French Drama of the Twentieth Century. (AL, FL) A survey of literature for the stage from 1890 to the present. One play each of Claudel, Maeterlinck, Jarry, Giraudoux, Cocteau, Ghelderode, Anouilh, Montherlant, Sartre, Camus, Genet, Ionesco, Beckett, Pinget, Vian, and Arrabal. C-L: Drama 123. One course. *Orr or Tufts*

165. French Existentialism. (CZ, FL) A critical introduction to the chief positions and controversies of French existentialism. One course. *Mudimbe*

166, 167. Contemporary French Life and Thought. (AL, FL) Major writers of the twentieth century and their historical and cultural circumstances. 166: Proust, Gide and the *Nouvelle revue française*, Colette, Alain-Fournier, Mauriac and the generation of 1914; the social novel of the 1930s. 167: Existentialism and *Les Temps Modernes*, the New Novel, the writer-critics, recent trends. C-L: Comparative Area Studies and Women's Studies. One course each. *Kaplan*

168. Francophone Literature. (AL, FL) Modern literature in French from French-speaking Africa and the French Caribbean. Topics include tradition and modernity; colonization, cultural assimilation, and the search for identity; and women in changing contexts. Prerequisite: good knowledge of French. C-L: African and Afro-American Studies 138, Asian and African Languages and Literature 168, and Comparative Area Studies. One course. *Mudimbe-Boyi*

169. The Contemporary Novel in French Canada. (AL, FL) Major trends in the novel since World War II: social revolt, proletarianism, political and religious liberation, and rejection of the past. C-L: Canadian Studies and Comparative Area Studies. One course. *Keineg*

191, 192. Independent Study. Directed reading and research. Open only to qualified juniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

193, 194. Independent Study. Directed reading and research. Open only to qualified seniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

200S. Seminar in French Literature. (AL, FL) Topics to be announced. One course. *Staff*

210. The Structure of French. (FL) Modern French phonology, morphology, and syntax. Readings in current linguistic theory. C-L: Linguistics. One course. *Thomas*

211. History of the French Language. (FL) The evolution of French from Latin to its present form; internal developments and external influences. C-L: Linguistics and Medieval and Renaissance Studies. One course. *Thomas*

223. Semiotics for Literature. (AL) Theoretical writings in general semiotics by Frege, Peirce, Saussure, Mukarovsky, and Morris and their applications for textual analysis of French literary works by representative contemporary critics such as Eco, Riffaterre, Corti, and Greimas. Taught in English. C-L: Literature 280. One course. *Thomas*

256. Modern Literature and History. (AL) The problems of history, society, and politics in literature, through the writings of Rousseau, Tocqueville, Michelet, Flaubert, Hugo, Merleau-Ponty, Foucault, and others. C-L: History 256. One course. *Orr*

258. The Narrative of Social Crisis. (AL, FL) Realism and naturalism, with special emphasis on Balzac, Flaubert, and Zola. One course. *Bell, Jameson, Orr, or Schor*

261. French Symbolism. (AL, FL) Poetry and theories of Baudelaire, Mallarmé, and Rimbaud. Decadence: Lautréamont and Laforgue. One course. *Thomas*

264. Contemporary French Poetry. (AL, FL) The language of poetry. A chronological and theoretical approach to the major poets and movements since 1950. Selections from Bonnefoy, Char, Daive, Deguy, Dupin, Jabès, Jaccottet, Faye, Guillevic, Michaux, Meschonnic, Noël, Oulipo, Ponge, Stefan, Tortel, and others. One course. *Orr or Thomas*

265. French Literature of the Early Twentieth Century. (AL, FL) Emphasis on Gide, Mauriac, Proust, and Colette. One course. *Kaplan*

266. French Literature of the Mid-Twentieth Century. (AL, FL) Emphasis on Malraux, Sartre, Camus, and the *nouveau roman*. One course. *Jameson*

281. Paradigms of Modern Thought. (AL) An introduction to contemporary French philosophy with a focus on the notions of identity and difference, the human origin of truth and the question of enunciation. French majors and French graduate students must do course work in French. One course. *Mudimbe*

Courses Currently Unscheduled

108S. French Women: Myths, Realities, and the Law. (CZ, FL)

112S. Special Topics in Advanced Language. (FL)

136S. Life in Eighteenth-Century France. (CZ, FL)

147. The Roots of Modernity in Seventeenth-Century Literature. (AL, FL)

155. Romanticism in French Literature. (AL, FL)

157. Difference and Representation. (AL, FL)

163. French Poetry of the Twentieth Century. (AL, FL)

170. Film and the French Novel. (AL, FL)

240. Old French Literature. (AL, FL)

257. Problems of Identity in the Nineteenth-Century Novel. (AL, FL)

263. Contemporary French Theater. (AL, FL)

290S. Studies in a Contemporary Figure. (AL, FL)

ITALIAN (IT)

1-2. Elementary Italian. (FL) Understanding, speaking, reading, and writing Italian. Language laboratory available for recording-listening practice. Two courses. *Staff*

11. Intensive Study of Italian. (FL) For beginners or intermediate students. Practice in understanding, speaking, reading, and writing; emphasis on spoken and written language patterns used in everyday life in Italy. Offered in the Duke in Bologna semester program. Placement test administered to returning students intending to continue Italian language studies. One course. *Staff*

21. Intensive Elementary Italian. (FL) Basic grammar structures in one semester; emphasis on oral work. Prerequisite: four semesters or the equivalent of another foreign language or consent of instructor. One course. *Staff*

22. Intensive Intermediate Italian. (FL) Readings in modern literature; analysis and discussion. Prepares students to enroll in courses at the 100 level. Prerequisite: Italian 21 or consent of instructor. One course. *Staff*

63. Intermediate Italian. (FL) Grammar review, reading, oral practice including laboratory experience. One course. *Staff*

76. Advanced Intermediate Italian. (FL) Oral practice, reading, and composition. Prerequisite: Italian 63 or achievement or placement test score of 550-590. One course. *Staff*

101, 102. Introduction to Italian Literature. (AL, FL) Major writers of the Italian literary tradition. Selections and complete works of poetry, fiction, theater, and essay. 101: Middle Ages to the seventeenth century. 102: Eighteenth, nineteenth, and twentieth centuries. Lectures and discussions; short essays and tests. Conducted in Italian. 101 cross-listed with Medieval and Renaissance Studies. One course each. *Caserta or Finucci*

105. Italian Women Writers. (AL, FL) Representative works by women from the Middle Ages to the modern period. Caterina da Siena, Colonna, Stampa, Aleramo, Deledda, Morante, and others. C-L: Comparative Area Studies and Women's Studies. One course. *Finucci*

110. Advanced Readings and Composition. (FL) Practice in writing; introduction to the techniques of literary styles. One course. *Finucci*

111S. Special Topics in Advanced Language. (FL) Intensive instruction in Italian using newspapers, short stories, and films in order to enhance oral fluency. One course. *Caserta*

122. Topics in Italian Literature in Translation. (AL) Single authors, genres, movements, or themes. Topics to be announced. One course. *Finucci*

131. Topics in Italian Civilization. (CZ, FL) The institutions and culture of Italy throughout the centuries. Topics to be announced. C-L: Comparative Area Studies. One course. *Finucci*

139. Modern Italy. (CZ, FL) Political, social, economic, and cultural problems in Italian history from 1861 to the present. One course. *Caserta*

141S, 142S. Italian Literature. (AL, FL) Topics to be announced. Open to juniors and seniors. One course each. *Staff*

145S. Topics in Renaissance Literature and Culture. (AL, FL) Topics may include: epic, women writers, treatises, Petrarchism, theater. C-L: Medieval and Renaissance Studies. One course. *Finucci*

151. The Italian Theater. (AL, FL) Introduction to the Italian theatrical tradition. Content varies; six to eight plays from the Renaissance to the present. One course. *Finucci*

170. Film and the Italian Novel. (AL, FL) Novels and classical narrative cinema. Topics such as novels and their cinematic versions, war, women's fiction and the woman's picture, and neorealism in novel and film. C-L: Comparative Area Studies and Film and Video. One course. *Finucci*

191, 192. Independent Study. Directed reading and research. Open only to qualified juniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

193, 194. Independent Study. Directed reading and research. Open only to qualified seniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

283. Italian Novel of the Novecento. (AL, FL) Representative novelists from Svevo to the most recent writers. One course. *Caserta*

284, 285. Dante. (AL, FL) 284: *La Vita Nuova* and a close reading of the *Inferno*. 285: The *Purgatorio* and the *Paradiso* in the light of Dante's cultural world. Special attention will be given to the poetic significance of the *Commedia*. Reading in Italian or English. Prerequisite: for 285, Italian 284 or equivalent. C-L: Medieval and Renaissance Studies. One course each. *Caserta*

Courses Currently Unscheduled

155S. Nineteenth-Century Italian Literature. (AL, FL)

PORTUGUESE (PTG)

21. Intensive Elementary Portuguese. (FL) Basic grammar structures in one semester; emphasis on oral work. Fall semester only. Prerequisite: four semesters of another foreign language or consent of instructor. One course. *Staff*

22. Intensive Intermediate Portuguese. (FL) Review of basic grammar; emphasis on reading, with some practice in writing. Prepares students to enroll in courses at the 100 level. Spring semester only. Prerequisite: Portuguese 21 or consent of instructor. One course. *Staff*

111S. Portuguese for Current Affairs. (FL) Advanced instruction in Portuguese using journalistic readings, film, and television, to improve fluency and to explore issues facing the Portuguese-speaking world. Prerequisite: Portuguese 22, or equivalent. One course. *Staff*

191, 192, 193, 194. Independent Study. One course each. *Staff*

200S. Seminar in Portuguese Literature. (AL, FL) Topics to be announced. One course. *Staff*

SPANISH (SP)

1-2. Elementary Spanish. (FL) Understanding, speaking, reading, and writing Spanish. Language laboratory available for recording-listening practice. Two courses. *Staff*

12. Review of Elementary Spanish. (FL) Intensive review of first-year Spanish. Open only to students with a placement or achievement score of 430-490. May not be taken for credit by students who have taken 1-2. One course. *Staff*

21. Intensive Elementary Spanish. (FL) Basic grammar structures in one semester; emphasis on oral work. Prerequisite: four semesters or the equivalent of another foreign language or consent of instructor. One course. *Staff*

22. Intensive Intermediate Spanish. (FL) Review of basic grammar; emphasis on reading, with some practice in writing. Prepares students to enroll in courses at the 100 level. Prerequisite: Spanish 21 or consent of instructor. One course. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

63. Intermediate Spanish. (FL) Grammar review, reading, and oral practice, including laboratory experience. Prerequisite: Spanish 2, 12, or achievement or placement test score of 500-570. One course. *Staff*

70, 71. Introduction to Literature. One or two course credits for advanced placement in literature. One course each.

76. Advanced Intermediate Spanish. (FL) Oral practice, reading, composition. Prerequisite: Spanish 63 or achievement or placement test score of 580-620. One course. *Staff*

101, 102. Introduction to Spanish Literature. (AL, FL) Major writers of the Spanish literary tradition. Poetry, fiction, theater, and essay. 101: Middle Ages through the seventeenth century. 102: eighteenth, nineteenth, and twentieth centuries. One course each. *Garci-Gómez, Osuna, or staff*

103S, 104S. Discussion of Readings. (AL, FL) Selected topics. Open only to freshmen and sophomores. One course each. *Staff*

105, 106. Introduction to Spanish-American Literature. (AL, FL) A survey of major writers and movements from the period of discovery to the present day. 105: the periods of conquest, colonial rule, and early independence. Includes works by native Indian, *mestizo*, and women writers. 106: from *modernismo* to the contemporary period. C-L: Comparative Area Studies. One course each. *Ross*

107S. Spanish-American Short Fiction. (AL, FL) Novellas and short stories of the nineteenth and twentieth centuries: Martí, Darío, Quiroga, Borges, Cortázar, García Márquez, Allende, Ferré, Carpentier, and others. One course. *Pérez Firmat*

110. Spoken Spanish. (FL) Practice in pronunciation and conversation, emphasis on oral communication. Prerequisite: Spanish 76 or consent of instructor. One course. *Staff*

111. Written Spanish. (FL) Grammatical problems in composition and translations; introduction to the techniques of literary and professional styles. One course. *Pérez Firmat or staff*

114S. Spanish Language: Peninsular or American. (FL) Topics to be announced. One course. *Staff*

117S. Advanced Grammar. (FL) A systematic study of modern Spanish morphology and syntax. Offered only in the Duke in Spain program. One course. *Staff*

118S. Advanced Colloquial Spanish. (FL) Colloquial Spanish as a catalyst of popular culture; extensive comparisons of English and Spanish popular sayings and proverbs; emphasis on oral communication. Prerequisite: two Spanish courses at the 100 level. One course. *Garci-Gómez*

119S. Structure of Spanish. (FL) A systematic study of modern Spanish morphology and syntax with some readings in current linguistic theory. Prerequisite: Spanish 110 or 111. C-L: Linguistics. One course. *Staff*

121. Latin-American Literature in Translation. (AL) Fictional and poetic works of the last thirty years that have made an impact on world literature. Taught in English. C-L: Comparative Area Studies and Literature 129. One course. *Dorfman*

131. Topics of Hispanic Civilization. (CZ, FL) A humanistic study of Spain or Spanish America through history, culture, people, and institutions. C-L: Comparative Area Studies. One course. *Staff*

137. Aspects of Contemporary Spanish Culture. (CZ, FL) Offered only as part of the summer program in Spain. C-L: Comparative Area Studies. One course. *Garci-Gómez*

138S. The Spanish Civil War in History and Literature. (AL, FL) An examination of the Spanish Civil War of 1936-39 through literary and historical readings, and through its representation in art, music, and film. One course. *Sieburth*

141S, 142S. Spanish Literature. (AL, FL) Topics to be announced. Open to juniors and seniors. One course each. *Staff*

143S. Literature of the Discovery and Conquest of America. (AL, FL) Prose and poetry from the sixteenth through eighteenth centuries, exploring the idea of the New World from conquest to independence. C-L: Comparative Area Studies. One course. *Ross*

144S. Spanish-American Literature of Identity. (AL, FL) Exploration of the concepts of *lo criollo* or *lo americano*, essentially through the analysis of texts by Arriví, Carpentier, Neruda, Paz, and others. C-L: Comparative Area Studies. One course. *Pérez Firmat*

145S. Literature of the Hispanic Minorities of the United States. (AL, FL) Representative Spanish-language works by Puerto Rican, Cuban-American and Chicano writers. C-L: Comparative Area Studies. One course. *Pérez Firmat*

146. The Spanish-American Novel. (AL, FL) Masterworks of the twentieth century. C-L: Comparative Area Studies. One course. *Staff*

147S. Latin American Women Writers. (AL, FL) Exploration of common themes across the region, such as family, love, feminism, and violence. May include only contemporary writers or cover authors from earlier periods as well. May study Brazilian writers in Spanish or in English translation. May concentrate on narrative or include poetry and drama. Open only to juniors and seniors. C-L: Comparative Area Studies and Women's Studies. One course. *Ross or staff*

148. Colonial and Postcolonial Studies in Latin America and the Caribbean. (CZ, FL) Focus on Western colonial expansion since the sixteenth century and on the national periods, following the movement of independence. Cultural differences of colonial and postcolonial experiences; transition from colonial to postcolonial regimes. Languages and literatures, history of ideas, cartography, and the social imaginary expressed in everyday life, from architecture to clothing, from rules of social behavior to ecological consciousness. Limited to juniors and seniors. One course. *Mignolo*

151. Spanish Literature of the Renaissance and the Baroque. (AL, FL) Selected works of the sixteenth and seventeenth centuries with attention to their reflection of social, religious, and political ideas. C-L: Medieval and Renaissance Studies. One course. *Ross or staff*

169. Topics in Nineteenth- and Twentieth-Century Spanish Literature. (AL, FL) Focus on a specific genre or theme to be announced. One course. *Sieburth or staff*

171. Literature of Contemporary Spain. (AL, FL) A sociological approach to the novel, theater, and poetry: Goytisolo, Buero Vallejo, Sastre, Arrabal, Celaya, and Otero. C-L: Comparative Area Studies. One course. *Osuna*

175S. Hispanic Literature and Popular Culture. (AL, FL) Works of Spanish and Latin American fiction that parody or rewrite popular culture genres such as serial novels, detective stories, or Hollywood films. Authors include Cervantes, Galdós, Borges, Marsé, and Puig. One course. *Sieburth*

176S. Disenchanted Texts: Spanish Literature 1975-1990. (AL, FL) Study of some of the literary works written in Spain between 1975 (year of Franco's death) and 1990, a period of political transition and social disenchantment. How this specific disenchantment is present in literary texts as an expression of an unconscious and repressed mourning for the Dictator as a father figure, as a nostalgia for a conflictive past, and as a confrontation with an uncertain present and future. Postdictatorship works of authors born in the 1920s and 1930s read alongside literary productions of the generation born after 1950. Authors include Goytisolo, Gil de Biedma, Vázquez Montalbán, Espinosa, Montero, Jaén, Ortiz, and others. One course. *Vilarós*

191, 192. Independent Study. Directed reading and research. Open only to qualified juniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

193, 194. Independent Study. Directed reading and research. Open only to qualified seniors by consent of instructor and Director of Undergraduate Studies. One course each. *Staff*

200S. Seminar in Spanish Literature. (AL, FL) Topics to be announced. One course. *Staff*

210. History of the Spanish Language. (FL) Formation and development. Internal forces and external contributions. C-L: Comparative Area Studies, Linguistics, and Medieval and Renaissance Studies. One course. *Garci-Gómez*

245. Modern Spanish-American Poetry. (AL, FL) From *modernismo* to the present. C-L: Comparative Area Studies. One course. *Staff*

248. Studies in Spanish-American Literature. (AL, FL) Concentration on single authors, genres, movements, or themes. One course. *Staff*

275. Modern Spanish Poetry. (AL, FL) Juan Ramón Jiménez, Unamuno, Antonio Machado, the Generation of 1927, and the contemporary poets. One course. *Osuna*

Courses Currently Unscheduled

14. Intensive Elementary Spanish. (FL)

100S. Introduction to Literary Analysis. (AL, FL)

108S. Spanish Traditional Poetry. (AL, FL)

109S. Contemporary Hispanic Ideas. (CZ, FL)

133S. Spanish-American Civilization. (CZ, FL)

153. Golden Age Literature: Cervantes. (AL, FL)

163. The Generation of 1898. (AL, FL)

165S. Major Spanish Authors. (AL, FL)

166. Nineteenth-Century Prose Fiction. (AL, FL)

262. The Romantic Movement. (AL, FL)

276. Modern Spanish Drama. (AL, FL)

277. Modern Spanish Novel. (AL, FL)

ROMANCE STUDIES (RS)

Courses Currently Unscheduled

218. The Teaching of Romance Languages

THE MAJOR

Majors are offered in Italian Studies, French, or Spanish.

Prerequisite. Italian, French, or Spanish 22, 76, or equivalents.

Major Requirements. Italian Studies: A total of eight courses numbered 100 or above. These must include at least two Italian courses above 140. Up to three approved courses on Italian subjects offered by other departments may be counted toward the major. Students may obtain a list of these courses from the departmental office. No more than

three courses may be taken in English either inside or outside the department. *French*: A total of eight courses numbered 100 or above. These must include 101, 102, and at least three courses above 140. *Spanish*: A total of eight courses numbered 100 or above. These must include two of the following: 101, 102, 105, 106; and at least three courses above 140.

Courses numbered 120 through 129 are taught in English and do not count toward the major (French and Spanish only). Course numbers 181 and 182 (now renumbered as 21, 22) do not count toward the major (French, Spanish, and Italian).

Study Abroad. Students are strongly urged to study abroad since this is the best way to achieve language proficiency and to acquire an intimate knowledge of a country's culture. A maximum of two courses per semester, or one per summer, may be counted toward the major. (The summer course restriction does not apply to Duke-sponsored programs.)

Suggested Work in Related Disciplines. In order to give perspective to a student's program, majors in French or Spanish will normally select, with the approval of the major advisor, appropriate courses from such fields as: (1) other languages and literatures; (2) history; (3) philosophy; (4) music and art; and (5) linguistics.

OPTION FRANÇAIS

Option Français is an offering of courses taught in French. Unlike the French courses offered by the Department of Romance Studies, however, in which language or literature is the essential subject matter, these are courses in various departments where French is simply the medium of instruction. Prerequisite: French SAT score of 600 (or the same score on the Placement Test), a score of 4 on the Advanced Placement Test in French, or prior completion of a French course numbered above 70. Option Français courses appear in the listings of the departments. They meet area of knowledge requirements as these are specified elsewhere in the undergraduate bulletin. They do not meet requirements for the major in French. Students interested in the program should consult the Director of Undergraduate Studies in Romance Studies.

Russian

For courses in Russian, see Slavic Languages and Literatures.

Science, Technology, and Human Values Program

Professor Emeritus Strobel, *Director*

A certificate, but not a major, is available in this program.

The Program in Science, Technology, and Human Values offers students the opportunity to develop a comprehensive view of science, medicine, or technology in social, historical, and ethical terms. Although a major is not available in this program, the course of study will enrich the understanding of one's profession for the future scientist, physician, or engineer, and for others it will broaden their appreciation of activities in these areas.

COURSE OF STUDY

Duke courses pertinent to the program are classified according to their approach: ethical, analytical (historical, philosophical, or sociological), or policy-centered. Each student entering the program designates, for purposes of advising, an area of primary interest and then selects a program of five courses (four for engineering majors) covering all three approaches. Individual programs, selected from more than fifty courses, are tailored to each student's interests. Students in the program focus their course work and individual interests through an interdisciplinary seminar offered in the senior year (Interdisciplinary Course 107S, 108S). A

seminar consisting of six varied topics in science, technology, and the humanities is offered as a course for undergraduates (Interdisciplinary Course 112S, 113S). Full details concerning the program and courses in science, technology, and human values may be obtained by writing or calling the Director.

ELIGIBILITY AND CERTIFICATION

Students may apply to the program at any time. To students who complete the program, Duke University gives official recognition of their participation.

Slavic Languages and Literatures

Associate Professor Lahusen, *Chair*; Associate Professor Pugh, *Director of Undergraduate Studies*; Associate Professors Andrews and Dobrenko; Assistant Professor Gheith; Associate Professor Emeritus Jezierski; Assistant Professors of the Practice Dolgova, Flath, Maksimova, and Van Tuyl; Adjunct Associate Professor and Slavic Bibliographer Pelech

A major is available in this department.

RUSSIAN (RUS)

1-2. Elementary Russian. (FL) Introduction to understanding, speaking, reading, and writing. Audiolingual techniques are combined with required recording-listening practice in the language laboratory. Two courses. *Staff*

4, 5. Elementary Russian Conversation. (FL) Introduction to spoken Russian with emphasis on basic conversational style and increasing vocabulary. Half course each. *Staff*

14. Intensive Russian. (FL) Russian 1 and 2 combined in one semester. Two meetings daily, as well as daily computer and language laboratory work. Two courses. *Staff*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

61S, 62S. Intermediate Russian Language and Culture. (CZ, FL) Intensive classroom practice in phonetics, conversation, and grammar. Literature, films, museums, and theater performances. (Taught in St. Petersburg in Russian and English depending on placement.) Prerequisite: Russian 2 or equivalent. One course each. *Staff*

63, 64. Intermediate Russian. (FL) Intensive classroom and laboratory practice in spoken and written patterns. Reading in contemporary literature. Prerequisites: Russian 1 and 2, or two years of high school Russian. One course each. *Staff*

66, 67. Russian Conversation. (FL) Consolidation of oral skills. Intensive conversation on a broad range of topics. Prerequisites: Russian 1 and 2, or equivalent. Half course each. *Staff*

70. Intensive Intermediate Russian. (FL) Russian 63 and 64 combined. Two meetings daily, as well as daily computer and language laboratory work. Two courses. *Staff*

100S. Russian Phonetics. (FL) Analysis of contemporary standard Russian literary pronunciation, phonology, and intonational structures. Prerequisite: Russian 64 or consent of instructor. One course. *Staff*

101S, 102S. Contemporary Russian Composition and Readings. (FL) Advanced grammar and syntax with intense composition component. Analytical readings in the original. Prerequisites: for 101S, Russian 63 and 64, or equivalent; for 102S, Russian 101S. One course each. *Staff*

103S, 104S. Studies in the Russian Language and Culture. (CZ, FL) Analytical readings including grammatical and textual analysis. Additional work in phonetics and conversation. Literature, films, museums, and theater performances. (Taught in St. Petersburg in Russian.) Prerequisite: Russian 64 or equivalent. C-L: Comparative Area Studies. One course each. *Staff*

110. Intensive Russian Composition and Readings. (AL, FL) Russian 101S and 102S combined in one course. Two meetings daily, as well as daily language laboratory work. Two courses. *Staff*

111S, 112S. Senior Honors Seminar. Introduction to methods of research and writing, including selection of thesis topics, preliminary research and organization, and writing of the thesis. Consent of the Director of Undergraduate Studies required. One course each. *Staff*

119, 120. Topics in Slavic and Northern European Languages. (FL) Introduction to one of the following languages: Bulgarian, Serbo-Croatian, Ukrainian, or Finnish. One year of a foreign language recommended. C-L: Linguistics. One course each. *Staff*

121S, 122S. Introduction to Russian Literature. (AL, FL) Major works in Russian literature including prose and poetry. Prerequisite: Russian 63, 64 or equivalent. One course each. *Staff*

129. Russian Orthodoxy. (CZ) The belief systems and the history of the Russian Orthodox Church. The relationship between orthodoxy and Russian secular culture, including the response of several Russian writers. Taught in English. C-L: Religion 126. One course. *Pelech*

130. Soviet Cinema. (AL) History of Soviet film industry from silent to sound period. Overview of major theorist-filmmakers: Eisenstein, Pudovkin, Vertov. Issues of reception, audience, politics, form, national and ethnic identities. Taught in English. C-L: Film and Video and Literature 178. One course. *Gaines, Jameson, and Lahusen*

131. Language, Culture, and Myth: The Slavic Proverb. (AL) The sources of the Slavic proverb, the proverb as microtext of national stereotypes, and its function in modern literature and culture. Problems of translation. Taught in English. C-L: Comparative Area Studies. One course. *Dolgora*

135. Contemporary Russian Media. (FL, SS) Analytical readings and study of change and development in all the primary forms of mass media in the former Soviet Union from 1985 to present (newspapers, journals, and television). Topics include censorship, TASS, samizdat. Taught in English, readings in Russian. Prerequisite: Russian 64 or equivalent. C-L: Comparative Area Studies. One course. *Andrews*

141, 142. Teaching Practicum. Introduction to teaching Russian. Practical classroom teaching experience in local elementary schools. Weekly sessions on teaching methodology. Consent of instructor required. One course each. *Andrews*

150. The Languages of the Soviet Union. (FL) Structural survey of the various language families represented in the former U.S.S.R., with special emphasis on national language policy, bilingualism, and language contact. Taught in English. C-L: Comparative Area Studies and Linguistics. One course. *Pugh*

161, 162. Nineteenth-Century Russian Literature. (AL) Selected nineteenth-century authors, works, and genres. Authors include Pushkin, Lermontov, Gogol, Turgenev, Dostoevsky, Tolstoy, and Chekhov. Taught in English. C-L: Comparative Area Studies. One course each. *Staff*

165S. Old Russian Literature. (AL) Literary works from the thirteenth to the eighteenth centuries. Taught in English. One course. *Staff*

169. Women and Russian Literature. (AL) Women authors in Russia from the eighteenth century to the present: their works and lives. The role that works by women have played in Russian literature and culture. The question of whether women's writing in Russia constitutes a tradition. Authors include Dashkova, Catherine the Great, Kovalevskaia, Kollontai, Chukovskaia, Akhmatova, Petrushevskaja, and Tolstaia. Taught in English. C-L: Comparative Area Studies and Women's Studies. One course. *Gheith*

170. Russian Dissident and Emigré Literature. (AL) The literature of opposition in Russia during the nineteenth and twentieth centuries, from Chaadaev and Chernyshevsky to Grossman, Solzhenitsyn, and Zinoviev. Taught in English. C-L: Comparative Area Studies. One course. *Lahusen*

172S. Pushkin and His Time. (AL) Pushkin and the literary revolution around 1830. Prose works (*The Tales of Belkin*, *The Queen of Spades*, *The Captain's Daughter*) and major lyrical poetry. Taught in English. C-L: Comparative Area Studies. One course. *Gheith or Van Tuyl*

173S. Gogol. (AL) Life, works, and criticism. Readings include *Dead Souls*, *The Inspector General*, *Petersburg Tales*, and other short fiction. Taught in English. C-L: Comparative Area Studies. One course. *Lahusen*

175. Tolstoy. (AL) Introduction to life, works, and criticism. Readings include: *War and Peace*, *Anna Karenina*, the shorter fiction, dramatic works and essays. Taught in English. C-L: Comparative Area Studies. One course. *Van Tuyl*

176. Dostoevsky. (AL) Introduction to life, works, and criticism. Readings include: *Crime and Punishment*, *The Idiot*, and *The Brothers Karamazov*. Taught in English. C-L: Comparative Area Studies. One course. *Flath, Gheith, or Van Tuyl*

177S. Chekhov. (AL) Drama and prose works. Taught in English. Not open to students who have taken Russian 174S (Chekhov). C-L: Comparative Area Studies. One course. *Flath or staff*

178. Leskov. (AL) His works, criticism, and life in the context of the literary culture of late nineteenth-century Russia. Works include: "The Leftlander," "Lady Macbeth of the Mtsensk District," "The Toupee Artist," "A Little Mistake," and "Night Owls." Taught in English. C-L: Comparative Area Studies. One course. *Gheith*

179S. Selected Topics in Russian Literature. (AL) Women writers of the twentieth century, Soviet film, *samizdat/tamizdat*, the Petersburg paradigm in Russian literature and culture. Taught in English. One course. *Staff*

180. Early Twentieth-Century Russian Literature: From Symbolism to the 1920s. (AL) Symbolism, acmeism, futurism, imagism, proletarian literature. Authors include Bely, Sologub, Blok, Vyacheslav Ivanov, Akhmatova, Mandelshtam, Mayakovsky, Khlebnikov, Gorky, Bogdanov, Gasterov. Taught in English. C-L: Comparative Area Studies. One course. *Lahusen or staff*

181. The 1920s: The Road to a New Synthesis. (AL) The literary struggle of the 1920s; proletarian literature from the Smithy to RAPP, LEF and the fate of the avant-garde, the aesthetic conception of Pereval, the literature of the absurd, Oberiu and the Serapion Brothers. Authors include Kirillov, Gladkov, Babel, Pilnyak, Olesha, Zamyatin, Platonov, Kharms, and Pasternak. Taught in English. Not open to students who have taken the former Russian 181, Early Twentieth-Century Russian Literature. C-L: Comparative Area Studies. One course. *Dobrenko or Lahusen*

182. Socialist Realism: Soviet Literature of the 1930s and 1940s. (AL) The Stalin era of Russian literature, the genesis and development of socialist realism, Soviet

literature and the themes of boundaries and war. Authors include Sholokhov, Ostrovsky, Fadeev, Azhaev, Babaevsky, Kochetov, and Simonov. Taught in English. C-L: Comparative Area Studies. One course. *Dobrenko or Lahusen*

183. Post-Stalinist and Contemporary Soviet Literature. (AL) Literature of the thaw after Stalin: the young prose, little realism, new modernism, and rural prose. Authors include Aksyonov, Trifonov, Baranskaya, Bitov, Solzhenitsyn, Rasputin, Shukshin, and Zalygin. Taught in English. C-L: Comparative Area Studies. One course. *Dobrenko or Lahusen*

184. Literature under and after Glasnost. (AL) From the "recovered" avant-garde to the new literature during the Gorbachev era and beyond. The unmasking of Soviet history and its aestheticization. Underground literature and Soviet postmodernism. Authors include Rybakov, Pietsukh, Petrushevskaya, Kuraev, Tolstaya, Viktor Erofeyev, Makanin, Prigov, and Narbikova. Readings in English. C-L: Comparative Area Studies and Linguistics. One course. *Dobrenko, Gheith, or Lahusen*

185S. Introduction to Slavic Linguistics. (FL) Basic introduction to linguistic terminology; emphasis on synchronic linguistic theory in the East, West, and South Slavic areas. Phonological, morphological, and syntactic structure of contemporary standard Russian. Readings in English and Russian. C-L: Comparative Area Studies and Linguistics. One course. *Andrews*

186S. History of the Russian Language. (FL) The development of the Russian language from the eleventh century, with consideration of the origins of modern literary and dialectal features. Readings in Russian. Prerequisite: second year Russian or consent of instructor. C-L: Comparative Area Studies and Linguistics. One course. *Pugh*

188S, 189S. Advanced Russian Language and Culture. (CZ, FL) Advanced grammar review with additional emphasis on phonetics and conversation. Literature, films, museums, and theater performances. (Taught in St. Petersburg in Russian.) Prerequisite: Russian 102S or equivalent. C-L: Comparative Area Studies. One course each. *Staff*

190. Introduction to Russian Civilization. (CZ) Basic knowledge of Russian society, history of ideas, folklore tradition, orthodoxy, and history of Russian readership. Taught in English. C-L: Comparative Area Studies and History 146. One course. *Pelech*

191, 192. Independent Study. Directed reading and research. Open only to qualified students by consent of Director of Undergraduate Studies. One course each. *Staff*

193, 194. Independent Study. Directed reading and research for qualified seniors. Consent of Director of Undergraduate Studies required. One course each. *Staff*

195. Advanced Russian. (FL) Advanced grammar review with an emphasis on the refinement of oral and written language skills. Development of writing style through compositions and essays. Prerequisite: Russian 102S or consent of instructor. C-L: Comparative Area Studies. One course. *Andrews*

196. Advanced Russian: Readings, Translation, and Syntax. (FL) Intensive reading and conversation with emphasis on contemporary Russian literary and Soviet press texts. English-Russian translation stressed. Russian media, including television and films. Prerequisite: Russian 195 or consent of instructor. C-L: Comparative Area Studies. One course. *Andrews*

197. Russian Poetry. (AL) Focus on nineteenth and twentieth centuries, including the Golden Age and the Silver Age. Authors include Pushkin, Lermontov, Bely, Blok, Akhmatova, Tsvetaeva, Mandelshtam, Pasternak, and Mayakovsky. Taught in English or Russian, according to students' Russian language proficiency. Russian texts. One course. *Staff*

198, 199. Russian Stylistics and Conversation. (AL, FL) Refinement of stylistic control and range in spoken and written Russian. Emphasis on fluent discursive skills, as well as development of expository prose style. Prerequisites: Russian 195 and 196, or consent of instructor. One course each. *Maksimova*

For Seniors and Graduates

201S. Topics in Comparative Slavic Linguistics. (SS) A cycle of survey courses on the phonology, morphology, and dialects of the Slavic languages. Taught in English. Readings in Russian.

A. East Slavic

B. West Slavic

C. South Slavic

D. Common Slavic

C-L: Linguistics. One course. *Andrews or Pugh*

203S. Old Church Slavonic. (FL) Introduction to the language of the earliest Slavic texts. Close study of phonological and morphological systems, reading of texts and discussion. Taught in English. C-L: Linguistics and Religion 229S. One course. *Pugh*

204S. Russian Folklore and Popular Culture. (CZ, FL) Work songs and ritual songs, lamentations, riddles, and proverbs. Tales and later forms of popular creation (*chastushki*, anecdotes, urban romance) and their function in Russian culture. Taught in Russian. One course. *Dolgova*

205. Semiotics and Linguistics. (SS) A survey of modern semiotics, particularly the works of C. S. Peirce and Umberto Eco. Semiotic works directly related to modern linguistic thought and linguistic sign theory. Emphasis on the interdisciplinary aspects of semiotic theory. C-L: English 205 and Linguistics. One course. *Andrews (Slavic)*

207S. Semantics. (SS) Survey of modern semantic theory, including a range of theoretical approaches: communication theory, structuralism, markedness, and generative semantics. Emphasis on lexical meaning and deictic relations. Taught in English. C-L: Linguistics. One course. *Andrews*

208. Stylistic and Compositional Elements of Scholarly Russian. (FL) Introduction to Russian texts and terminology including business, economics, law, history, political sciences, psychology, linguistics, and literary criticism. Prerequisite: Russian 64 or consent of instructor. One course. *Maksimova*

210. Literature and Criticism of Socialist Realism. (AL) The genesis and development of Soviet socialist realism. A survey of Soviet literary theories from Lunacharsky to Ovcharenko, and contemporary Western criticism (for example, K. Clark, R. Robin). A critical approach to the dialogic alternative to monologic literature through literary illustration (selected Soviet literary works from the 1930s to the present day). Taught in English. One course. *Lahusen*

230. Soviet Cinema. (AL) History of Soviet film industry from silent to sound period. Overview of major theorist-filmmakers: Eisenstein, Pudovkin, Vertov. Issues of reception, audience, politics, form, national and ethnic identities. Taught in English. One course. *Gaines, Jameson, and Lahusen*

240S. Russian Literary Discourse. (AL) Nineteenth- and twentieth-century Russian literary theory, with close readings in the original. Application to fiction. Taught in English. One course. *Lahusen*

250. Trends in Russian and East European Literary Criticism and Beyond. (AL) The major critical movements in the nineteenth and twentieth centuries in Russia,

East-Central Europe, and the West. Authors and theories include the Belinsky school, formalism, Bakhtin, structuralism, semiotics, and psychoanalytic and feminist theory. Taught in English. One course. *Gheith*

261, 262. (AL) Nineteenth-Century Russian Literature. Selected nineteenth-century authors, works, and genres. Authors include Pushkin, Lermontov, Gogol, Turgenev, Dostoevsky, Tolstoy, and Chekhov. Taught in English. Readings in Russian. One course each. *Staff*

265S. Literature of Early Russia. (AL) Works from the eleventh to the seventeenth centuries, including Ilarion's *Sermon on Law and Grace*, *The Tale of Bygone Years*, *The Igor Tale*, *Domostroi*, *Avvakum's Life*. Readings in Russian. One course. *Dolgova and staff*

266S. The Sources of Modern Russian Literature: The Eighteenth Century. (AL) Development of the major forms of Russian literature, including verse, drama, and the beginnings of the prose tradition. Authors include Kantemir, Lomonosov, Sumarokov, Trediakovsky, Fonvizin, Derzhavin, and Karamzin. Readings in Russian. One course. *Gheith*

269. Women and Russian Literature. (AL) Women authors in Russia from the eighteenth century to the present: their works and lives. The role that works by women have played in Russian literature and culture. The question of whether women's writing in Russia constitutes a tradition. Authors include Dashkova, Catherine the Great, Kovalevskaja, Kollontai, Chukovskaja, Akhmatova, Petrushevskaja, and Tolstaia. Taught in English. Readings in Russian. C-L: Comparative Area Studies and Women's Studies. One course. *Gheith*

272S. Pushkin and His Time. (AL) Pushkin and the literary revolution around 1830. Prose works (*The Tales of Belkin*, *The Queen of Spades*, *The Captain's Daughter*) and major lyrical poetry. Taught in English. Readings in Russian. One course. *Gheith or Van Tuyl*

273S. Gogol. (AL) Life, works, and criticism. Readings include *Dead Souls*, *The Inspector General*, *Petersburg Tales*, and other short fiction. Readings in Russian. One course. *Lahusen*

275. Tolstoy. (AL) Introduction to life, works, and criticism. Readings include: *War and Peace*, *Anna Karenina*, the shorter fiction, dramatic works and essays. Taught in English. Readings in Russian. One course. *Van Tuyl*

276. Dostoevsky. (AL) Introduction to life, works, and criticism. Readings include: *Crime and Punishment*, *The Idiot*, and *The Brothers Karamazov*. Taught in English. Readings in Russian. C-L: Comparative Area Studies. One course. *Flath, Gheith, or Van Tuyl*

277S. Chekhov. (AL) Drama and prose works. Readings in Russian. One course. *Flath*

279S. Literature of the Former Soviet Republics. (AL) Ukrainian realism of the nineteenth century, futurism, neoclassicism, and the literary struggle of the 1920s; Belorussian literature; Lithuanian psychological prose; the Estonian experimental novel; Georgian literature from Rustaveli to the philosophical novel of the 1970s; the work of Chingiz Aitmatov; Soviet "recent literacy." Taught in Russian. One course. *Dobrenko*

280. Early Twentieth-Century Russian Literature: From Symbolism to the 1920s. (AL) Symbolism, acmeism, futurism, imagism, proletarian literature. Authors include Bely, Sologub, Bryusov, Blok, Vyacheslav Ivanov, Khodasevich, Akhmatova, Mandelstam, Mayakovsky, Khlebnikov, Gorky, Bogdanov, Gastev. Readings in Russian. One course. *Lahusen*

281. The 1920s: The Road to a New Synthesis. (AL) The literary struggle of the 1920s; proletarian literature from the Smithy to RAPP, LEF and the fate of the

avant-garde, the aesthetic conception of Pereval, the literature of the absurd, Oberiu and the Serapion Brothers. Authors include Kirillov, Gladkov, Babel, Pilnyak, Olesha, Zamyatin, Platonov, Kharms, and Pasternak. Readings in Russian. One course. *Dobrenko or Lahusen*

282. Socialist Realism: Soviet Literature of the 1930s and 1940s. (AL) The Stalin era of Russian literature, the genesis and development of socialist realism, Soviet literature and the theme of boundaries and war. Authors include Sholokhov, Ostrovsky, Fadeev, Azhaev, Babaevsky, Kochetov, and Simonov. Readings in Russian. One course. *Dobrenko or Lahusen*

283. Post-Stalinist and Contemporary Soviet Literature. (AL) Literature of the thaw after Stalin: the young prose, little realism, new modernism, and rural prose. Authors include Aksyonov, Trifonov, Baranskaya, Bitov, Solzhenitsyn, Rasputin, Shukshin, and Zalygin. Readings in Russian. C-L: Comparative Area Studies. One course. *Dobrenko or Lahusen*

284. Literature under and after Glasnost. (AL) From the "recovered" avant-garde to the new literature during the Gorbachev era and beyond. The unmasking of Soviet history and its aestheticization. Underground literature and Soviet postmodernism. Authors include Rybakov, Pietsukh, Petrushevskaya, Kuraev, Tolstaya, Viktor Erofeyev, Makanin, Prigov, and Narbikova. Readings in Russian. One course. *Dobrenko, Gheith, or Lahusen*

285. Babel and the Russian-Jewish Cultural Dialogue of the Twentieth Century. (AL) The Jews and the Russian revolution. The Odessa school in the literature of the 1920s. Works include *Red Cavalry*, *Odessa Stories*, and *The Sunset*. Readings in English or Russian. One course. *Dobrenko*

286S. Zamyatin. (AL) The novel *We*, short fiction, and essays. Taught in English. Readings in English or Russian. Not open to students who have taken the former Russian 177S/277S (Zamyatin). One course. *Andrews, Maksimova, or Lahusen*

287S. Platonov. (AL) The novels *Chevoengur*, *The Foundation Pit*, and shorter fiction. Taught in English. Readings in English or Russian. One course. *Lahusen*

288S. Bulgakov. (AL) Works include *Master and Margarita*, *The White Guard*, *A Theatrical Novel*, and *The Heart of a Dog*. Readings in English or Russian. One course. *Andrews, Maksimova, and staff*

290. Trifonov, or the Life and Death of the Soviet Intelligentsia. (AL) The Russian and Soviet intelligentsia, its role and historical responsibility, depicted by one of the most visible representatives of the "generation of the sixties." Works include *The Exchange*, *Taking Stock*, *The Long Goodbye*, *Another Life*, *The House on the Embankment*, *The Old Man*. Readings in Russian. One course. *Dobrenko*

298. Akhmatova. (AL) The works and times of Anna Akhmatova, the most prominent woman poet in Russian history. Focus on Akhmatova's works and the Russian political and artistic milieu of the 1910s and 1920s, socio-literary issues of later periods. Readings include the lyric poems of 1910-60, *Requiem*, and *Poem Without a Hero*. Readings in Russian. One course. *Van Tuyt*

BALTO-FINNIC (BF)

1-2. Elementary Estonian. (FL) Introduction to understanding, speaking, reading, and writing Estonian. No preliminary knowledge of Estonian necessary. Two courses. *Pugh*

3-4. Elementary Finnish. (FL) Introduction to understanding, speaking, reading, and writing Finnish. No preliminary knowledge of Finnish necessary. Two courses. *Pugh*

200. Balto-Finnic Linguistics. (FL) Introduction to Balto-Finnic languages with emphasis on the established literary languages, Finnish and Estonian. Analysis of their phonological and morphological structures. Survey of related nonliterary languages such as Karelian and Vepsian. Taught in English. C-L: Linguistics. One course. *Pugh*

POLISH (POL)

1-2. Elementary Polish. (FL) Introduction to understanding, speaking, reading, and writing Polish. No preliminary knowledge of Polish necessary. Two courses. *Lahusen*

14. Intensive Elementary Polish. (FL) Polish 1 and 2 combined in one semester. Two meetings daily. Required recording-listening practice in the language laboratory. Work on understanding, speaking, reading, and writing. Survey of main elements of grammar. No preliminary knowledge of Polish necessary. Two courses. *Lahusen and staff*

63, 64. Intermediate Polish. (FL) Intensive classroom and laboratory practice in spoken and written patterns. Readings in contemporary literature. Prerequisites: Polish 1 and 2, or consent of instructor. One course each. *Lahusen*

187. Introduction to Polish Literature. (AL) Survey of nineteenth- and twentieth-century Polish literature. Taught in English. C-L: Comparative Area Studies. One course. *Lahusen*

Courses Currently Unscheduled

100. Poland in Transition. (CZ)

174S. Topics in Polish Literature. (AL)

SERBIAN AND CROATIAN (SCR)

1-2. Elementary Serbian and Croatian. (FL) Introduction to understanding, speaking, reading, and writing Serbian and Croatian. No preliminary knowledge of Serbian and Croatian necessary. Two courses. *Andrews*

14. Intensive Elementary Serbian and Croatian. (FL) Serbian and Croatian 1 and 2 combined in one semester. Two meetings daily. Required recording-listening practice in the language laboratory. Work on understanding, speaking, reading, and writing. Survey of main elements of grammar. No preliminary knowledge of Serbian and Croatian necessary. Two courses. *Andrews*

UKRAINIAN (UKR)

1-2. Elementary Ukrainian. (FL) Introduction to understanding, speaking, reading, and writing Ukrainian. No preliminary knowledge of Ukrainian necessary. Two courses. *Dobrenko or Pugh*

14. Intensive Elementary Ukrainian. (FL) Ukrainian 1 and 2 combined in one semester. Two meetings daily. Required recording-listening practice in the language laboratory. Work on understanding, speaking, reading, and writing. Survey of main elements of grammar. No preliminary knowledge of Ukrainian necessary. Two courses. *Dobrenko or Pugh*

187. Introduction to Ukrainian Literature. (AL) Nineteenth- and twentieth-century Ukrainian literature. Taught in English or Russian. C-L: Comparative Area Studies. One course. *Dobrenko*

THE MAJOR

Prerequisites. Russian 1-2 and 63, 64 or equivalent.

Major Requirements. A minimum of eight courses in the department. All majors must take the following courses: Russian 101S, 102S, 195, 196. Each major is required to take one course in nineteenth-century Russian literature and one course in twentieth-century Russian literature. Two areas of specialization are offered. Students contemplating graduate work are strongly encouraged to choose from one of the two following concentrations within the standard major.

Literature Concentration: either 121 or 122; and one other course to be approved by the department.

Linguistics Concentration: Both 185S and 186S.

Sociology (SOC)

Professor Land, *Chair*; Professor Wilson, *Director of Undergraduate Studies*; Professors DiPrete, George (psychiatry and aging center), Kerckhoff, Lin, Maddox, Myers, O'Barr (cultural anthropology), Simpson, Smith, and Tiryakian; Associate Professors Gereffi, O'Rand, and Spenner; Assistant Professors Janoski, Parnell, and Reed; Professors Emeriti Back and Preiss; Adjunct Professors Cook (public policy) and Lewin (business); Adjunct Associate Professor Weinberger (psychiatry and aging center); Adjunct Assistant Professors Gold (psychiatry and aging center) and Haveman (business); Adjunct Research Professor Manton (demographic studies); Visiting Professor Gittler; Lecturer Luttrell

A major is available in this department.

Sociology combines an appreciation of human beings' capacity for self-realization with a scientific understanding of the causes and consequences of their social behavior. Each course aims to develop both the analytical and critical skills necessary for understanding and evaluating social institutions and social change. Emphasis is upon contemporary research and the use of sociological data in tackling social problems. Active involvement in the learning process is fostered through seminars, independent study, honors work, and internships.

10D. Introduction to Sociology. (SS) Structure and dynamics of groups, organizations, and institutions; social behavior over the life cycle; social control and deviance; population and social ecology; formation and change of societies. Two lectures and one discussion section. One course. *Janoski or Parnell*

11. Contemporary Social Problems. (SS) A survey of approaches to the study of current social problems and social trends. Sexism, racism, age discrimination; job displacement by technological change; social consequences of environmental pollution; unemployment and poverty; interpersonal problems associated with changes in family structures; maldistribution of health care and educational opportunities; deviance. One course. *Land or Reed*

Social Issues of Contemporary Society. Topics vary from semester to semester. One course each. *Staff*

20S. Individual and Society. (SS) One course.

22S. The Third World. (SS) One course.

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

98. Introduction to Canada. (SS) See C-L: Interdisciplinary Course 98; also C-L: Canadian Studies, Economics 98, History 98, and Political Science 98. One course. *Cahow or Thompson*

101B, S. Science and Technology in Twentieth-Century America. (SS) Science and technology as embedded in social and political institutions that constrain and promote their development over time. The complex and dynamic set of relations during the twentieth century across scientific and technological domains (for example, cybernetics, atomic energy, and biotechnology). Particularly controversial events and theories that illustrate these relations. Open only to students in the FOCUS Program. One course. *O'Rand*

101S. Contemporary American Society. (SS) Social trends and problems and their effects on individuals and society. Urbanization; bureaucracy; distribution of wealth, income, and power; status of minorities. One course. *Kerckhoff or Spenner*

106. Social Psychology. (SS) See C-L: Psychology 116; also C-L: Women's Studies. One course. *Costanzo, Fischer, or George*

110, A-E. Comparative Sociology: Selected Areas. (SS) Comparative studies of selected areas of the world, considering differences and similarities in culture and communication, family, law and social control, urban forms and the organization of work. Areas vary each semester offered and are designated by letter.

A. Africa

B. Asia

C. Europe

D. Latin America

E. Cross-Regional

C-L: Comparative Area Studies. One course. *Gereffi, Janoski, Lin, Myers, Smith, or Tiryakian*

111. Inequality in America. (SS) Differences in social position in the United States as they relate to income, prestige, and power. Primary focus on the process of achievement, including level of education and occupational position, while controlling for race, sex, and age. C-L: Women's Studies. One course. *Kerckhoff or O'Rand*

112. American Demographics. (SS) Examination of trends in the fertility, migration, geographic distribution, and composition of the United States population. Consequences for lifestyles, social trends, consumer markets, health care, and public policy. One course. *Land, Myers, or Parnell*

116. Race and Ethnic Relations. (SS) History and changing nature of race and ethnic relations, with special reference to the United States. Sources, forms, and consequences of racial discrimination; movements for racial integration and separatism; the intersection of race, class, and gender. C-L: African and Afro-American Studies 116. One course. *Staff*

117. Childhood in Social Perspective. (SS) Social forces affecting the place and purpose of children in society, their relations to adults and their treatment by social institutions such as schools and governments. Topics include parent-child relations, sibling relations, child abuse, children's rights, child labor, and the portrayal of children in the mass media. One course. *Simpson*

118. Sex, Gender, and Society. (SS) Nature and acquisition of sex roles. Cross-cultural variations. Developing nature of sex roles in American society. C-L: Comparative Area Studies and Women's Studies. One course. *O'Rand*

119. Juvenile Delinquency. (SS) Environments in which juvenile delinquency develops; delinquent subcultures and peer groups; societal reactions to delinquency in schools, courts, and other agencies. One course. *Land or Reed*

Sociology 120, 122, and 123 are designed as a sequence and might optimally be taken in that order, with Sociology 120 being recommended preparation for 122 and 123. However, there are no prerequisites.

120. Causes of Crime. (SS) Definition, types, and extent of crime; biological, psychological, economic, and social causes of criminality; explanation and critical evaluation of theories of crime; structure and patterns of recruitment of criminal organizations; social reactions to crime and the justice system. One course. *Land or Reed*

122. Punishment and Treatment of Deviants. (SS) Concepts of punishment and rehabilitation. Programs and facilities for deviants. Structure and operation of "total" institutions, such as prisons and hospitals. Problems of returning to family and community life. One course. *Reed or Simpson*

123. Social Aspects of Mental Illness. (SS) Theoretical and practical sociological contributions to problems of etiology, definition, law, and treatment; comparisons with other contributions; questions of public policy and programs. One course. *Reed*

124. Human Development. (SS) Especially for sophomores. Juniors and seniors by consent only. See C-L: Interdisciplinary Course 124; also C-L: Human Development and Psychology 124. One course. *N. Anderson and staff*

125. Strategies of Comparative Analysis. (SS) See C-L: Comparative Area Studies 125; also C-L: Cultural Anthropology 125, History 137, Political Science 125, and Religion 121. One course. *Gereffi or Janoski*

126. Third World Development. (SS) Theories concerning the role of transnational corporations and international financial institutions (for example, World Bank) in the development of Third World nations, assessed with the aid of sociological and economic data. C-L: Comparative Area Studies. One course. *Gereffi*

132. Methods of Social Research. (SS) Principles of social research, design of sociological studies, sampling, and data collection with special attention to survey techniques. One course. *DiPrete or Lin*

133. Statistical Methods. (QR) Elementary statistical techniques and their application to the analysis and interpretation of social science data. Theory of inference is stressed. C-L: Psychology 117. One course. *Land or Spenner*

135. Computers and Society. (SS) The impact of the computer and related technologies on society. Topics include the effects on individual freedom and the nature of work, the implications of high speed information retrieval, and others. One course. *Smith or Spenner*

138. History of Social Thought. (SS) Theories of society and social relations in the writings of Montesquieu, Rousseau, Comte, Marx, Weber, Durkheim, Simmel, Veblen, Sorokin, and others. The history of sociology in relation to philosophical currents, social movements, and transformation of the modern world. One course. *Tiryakian or Wilson*

139. Marxism and Society. (SS) See C-L: Cultural Anthropology 139; also C-L: Comparative Area Studies, Education 139, History 186, and Interdisciplinary Course 139. One course. *Wilson*

142. Organizations and Global Competitiveness. (SS) Competition between national economies as understood in the context of social factors such as ethnicity, kinship, gender, education, with a special emphasis on the role of multi-national corporations, public bureaucracies, and small firms. One course. *Gereffi*

143. Management and Labor Relations. (SS) Theories and current research on the interlocking roles of business and labor in the United States and elsewhere. One course. *Gereffi or Janoski*

144. Organizations and Environments. (SS) How organizations (governments, cultures, and technology) are affected by the environment in which they must operate. Competitive strategies (for example, takeovers and mergers); corporate cultures (for example, United States versus Japan); and the impact of technology. One course. *Gereffi*

149. Sexuality and Society. (SS) Sociocultural factors affecting sexual behavior. Changing beliefs about sex; how sexual knowledge is socially learned and sexual identities formed; the relation between power and sex; control over sexual expression. One course. *Luttrell or Tiryakian*

150. The Changing American Family. (SS) Structure, organization, and social psychology of marital, parental, and sibling relations over the life cycle of a family; courtship, marriage, family dissolution in relation to contemporary American society; deviations from and alternatives to the traditional nuclear family. C-L: Women's Studies. One course. *Simpson*

151. Sociology of Religion. (SS) The religious factor in modern society and the social factor in modern religion. Major sociological theories and marginal religious groupings. One course. *Tiryakian or Wilson*

153. Sport and Society. (SS) The effect of sports on people, their self-image, and social roles. Relation of sports as an institution to the family, education, economics, and politics. One course. *Wilson*

154. Art and Literature in Society. (SS) An analysis of the social relations of the world of the arts (painting and sculpture, music, and literature) with emphasis upon creative artists, art publics, art organizations, and artworks as they function in their social-cultural milieu. One course. *Lin, Luttrell, or Tiryakian*

155. Organizations and Management. (SS) Forms of work organization (corporations, government agencies), the social forces shaping them (management styles, technology, government policy, labor markets), and their effects on employees (productivity, work satisfaction, turnover). C-L: Women's Studies. One course. *DiPrete or Janoski*

156. Global Contexts of Science and Technology. (SS) National variations in the structures of scientific systems, and their consequences for the production and application of scientific knowledge, paying particular attention to how these variations are shaped by national differences in politics, economics, and education. Special focus on recent developments in the biomedical sciences, such as genetic engineering and biotechnology. One course. *O'Rand*

157. The Legal Profession and the Law. (SS) Development of the American legal profession, emphasizing the recruitment and training of lawyers, the ways lawyers' work is organized, the role of professional associations, the determinants of success in legal practice, and the influence of legal ethics on practice. One course. *Simpson or Wilson*

158. Markets and Marketing. (SS) Markets as systems of social exchange: how they are organized and developed; their relationship to other social structures such as families, work organizations, and the state; their impact on individuals, careers, consumption patterns, and lifestyles. One course. *DiPrete or Spenner*

159. The Sociology of Entrepreneurship. (SS) The social origins and careers of entrepreneurs. The interrelation of their work and family roles and the distinctiveness

of their values and interests. The role of entrepreneurial activity in societal development, and its function in different industries, ethnic groups, and societies. One course. *Staff*

160. Advertising and Society. (SS) See C-L: Cultural Anthropology 110; also C-L: English 120, Film and Video, and Women's Studies. One course. *Luttrell, O'Barr, Smith, or Wilson*

161. Adulthood and Aging. (SS) Sociological and psychological perspectives on aging, from adolescence through old age and death; demography of human aging; problems caused by increased longevity; policy issues. C-L: Women's Studies. One course. *George or O'Rand*

162. Health and Illness in Society. (SS) Relations between patients and health professionals, and utilization of resources for health care. One course. *Lin or Weinberger*

163. Aging and Health. (SS) Illness and health care utilization among the elderly, comparison to other populations, gender and race differences, medicare and medicaid, individual adjustment to aging and illness, social support for sick elderly, the decision to institutionalize, policy debate over euthanasia. One course. *George or Gold*

165. Occupations, Professions, and Careers. (SS) How occupations organize and control labor markets, define services, chart career lines, and develop and sustain occupational identities. C-L: Women's Studies. One course. *O'Rand, Simpson, or Spenner*

167. The Social Bases of Politics. (SS) Theories of and research on political power at the community, national, and international levels. C-L: Canadian Studies and Women's Studies. One course. *Gereffi or Smith*

169. Psychosocial Aspects of Human Development. (SS) See C-L: Psychology 130; also C-L: Human Development and Interdisciplinary Course 180. One course. *Martin Lakin and Maddox*

170. Mass Communication. (SS) An analysis of the role of radio, the press, magazines, movies, and television. An examination of the selective audiences, content characteristics, controlling elements, and organizational structure of the various media. Comparative Canadian material considered where feasible. C-L: Canadian Studies, Comparative Area Studies, and Film and Video. One course. *Smith*

171. Comparative Health Care Systems. (SS) The interaction of historical, political, economic, legal/ethical, and sociological factors in the organization and operation of health care systems in the United States, the United Kingdom, Sweden, and elsewhere. C-L: Canadian Studies and Comparative Area Studies. One course. *Maddox*

173. Social Conflict and Social Movements. (SS) Mobilization and strategy of riots, demonstrations, public interest groups, social movements, and revolutions. One course. *Tiryakian or Wilson*

175. Contemporary Global Issues. (SS) See C-L: Comparative Area Studies 109; also C-L: Cultural Anthropology 109, History 109, and Political Science 160. One course. *Staff*

179. Modern Nationalist Movements. (SS) A comparative sociological study of major nationalist movements. First World nationalism in industrial societies, Third World nationalism in colonial and postcolonial societies, and recent Second World nationalism in socialist societies. C-L: Canadian Studies and Comparative Area Studies. One course. *Tiryakian*

182. Media in Comparative Perspective. (SS) See C-L: Interdisciplinary Course 182; also C-L: Canadian Studies, Comparative Area Studies, Film and Video, and Political Science 180. One course. *Paletz or Smith*

184S. Canadian Issues. (SS) Prerequisite: Interdisciplinary Course 98 or consent of instructor. See C-L: Interdisciplinary Course 184S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 184S, Economics 184S, History 184S, and Political Science 184S. One course. *Cahow or Thompson*

188. The Sociology of Contemporary Spain. (SS) An overview of the social transformations shaping Spain during the last half-century. Topics covered include the political system, regional autonomous movements, family and educational systems, folklore, and religion. One course. *Staff*

193, 194. Independent Study. Consent of instructor required. One course each. *Staff*

195S, 196S, 197S. Seminar in Special Topics. One course each. *Staff*

For Seniors and Graduates

206. Sociological Theory. (SS) Structure, foundations, and historical antecedents of recent formulations of such theoretical approaches as phenomenological sociology, exchange theory, critical theory, structuralism, neo-Marxist sociology, sociobiology, and action theory. One course. *Tiryakian or Wilson*

207. Social Statistics I: Basic Concepts and Methods. (QR) Review of descriptive statistics; probability concepts; statistical inference, t-tests, and the analysis of variance. Bivariate correlation and regression, dummy variables, multiple regression, and the analysis of covariance. Stress on applications. Statistical computing using SPSS and other programs. One course. *DiPrete or Land*

208. Survey Research Methods. (SS) Theory and application of survey research techniques in the social sciences. Sampling, measurement, questionnaire construction and distribution, pretesting and posttesting, response effects, validity and reliability, scaling of data, data reduction and analysis. Prerequisite: Sociology 207 or the equivalent. One course. *Kerckhoff, Lin, or Smith*

211S, A-E. Proseminars in Sociological Theory. (SS) Development of sociological thought; systematic sociological theory; interrelations with other social and behavioral sciences.

- A. Background of Sociology
- B. Formal Aspects of Theory
- C. Sociology of Knowledge
- D. Evolutionary Theory and Sociobiology
- E. Special Topics in Sociological Theory

One course. *Tiryakian or Wilson*

212. Social Statistics II: Linear Models, Path Analysis, and Structural Equation Systems. (QR) Model specification, review of simple regression, the Gauss-Markov theorem, multiple regression in matrix form, ordinary and generalized least squares, residual and influence analysis. Path analysis, recursive and nonrecursive structural equation models; measurement errors and unobserved variables. Application of statistical computing packages. Prerequisite: Sociology 207 or equivalent. One course. *DiPrete or Land*

213. Social Statistics III: Discrete Multivariate Models. (QR) Assumptions, estimation, testing, and parameter interpretation for the log-linear, logit, logistic, and probit

models. Model comparisons; applications of statistical computing packages and programs. Prerequisite: Sociology 212 or equivalent. One course. *DiPrete or Land*

214. Comparative and Historical Methods. (SS) Introduction to the theory of comparative research and analysis in the social sciences with special emphasis on comparative methods, quasi-experimental designs, and case studies. C-L: Comparative Area Studies and Political Science 217. One course. *Archer, Gereffi, Janoski, Lin, Smith, or Tiryakian*

215. Basic Demographic Methods and Materials. (SS) Population composition, change, and distribution. Methods of standardizing and decomposing rates, life tables and population models, analysis of data from advanced and developing countries. Applications of computer programs for demographic analysis. Prerequisite: Sociology 207 or equivalent. One course. *Myers or Parnell*

216. Advanced Methods of Demographic Analysis. (SS) Theory and estimation methods for life tables. Reproductivity, the stable population model. Graduation, interpolation, and other data adjustments for faulty data. Hazards modeling. Applications of computer packages for demographic analysis. Prerequisite: Sociology 215 or equivalent. One course. *Land or Parnell*

217S, A-F. Proseminars in Social Statistics and Research Methods. (SS) Selected topics in the collection and analysis of social science data.

- A. Discrete and Continuous Models of Measurement
 - B. Hazards Models, Event History Analysis, and Panel Data
 - C. Dynamic Models and Time Series Analysis
 - D. Research Design
 - E. Evaluation Research Methods
 - F. Special Topics in Social Statistics and Research Methods
- One course. *DiPrete or Land*

221S, A-D. Proseminars in Aging and Life Course Analysis. (SS) Selected topics in socialization, human development, status attainment and careers, and the sociology of aging.

- A. Social Structure and the Life Course
 - B. Social Patterns of Personal Development
 - C. Social Gerontology
 - D. Special Topics in Aging and Life Course Analysis
- One course. *Maddox, Myers, O'Rand, or Spenner*

222S, A-D. Proseminars in Comparative and Historical Sociology. (SS) Selected topics in the differentiation and transformation of societies.

- A. Theories of Social Change
 - B. Comparative Aspects of Societal Transformation
 - C. Theories of Change in Third World
 - D. Special Topics in Comparative and Historical Sociology
- One course. *Gereffi, Lin, Simpson, Smith, or Tiryakian*

223S, A-E. Proseminars in Crime, Law, and Deviance. (SS) Selected topics in crime and the institutions of social control.

- A. Theories of Crime Causation
- B. Human Development and Criminal Careers
- C. Social Control and the Criminal Justice System

- D. Sociology of Law
 - E. Special Topics in Crime, Law, and Deviance
- One course. *Land, Reed, Simpson, or Wilson*

224S, A-F. Proseminars in Population Studies. (SS) Selected topics.

- A. Population Dynamics
- B. Mortality, Morbidity, and Epidemiology
- C. Urbanization and Migration
- D. Demography of the Labor Force
- E. Demography of Aging
- F. Special Topics in Population Studies

One course. *DiPrete, Land, Maddox, Manton, Myers, O'Rand, Parnell, or Smith*

225S, A-E. Proseminars in Organizations, Markets, and Work. (SS) Selected topics in complex organizations, the labor process, and changing occupations.

- A. Organizations and Environments
- B. The Social Psychology of Organizations
- C. Markets and Market Behavior
- D. Careers and Labor Markets
- E. Special Topics in Organizations, Markets, and Work

One course. *DiPrete, Janoski, O'Rand, or Spenner*

226S, A-G. Proseminars in Social Institutions and Processes. (SS) Selected topics in the sociology of institutions and social and institutional behavior.

- A. Social Psychology
- B. Social Stratification
- C. Political Sociology
- D. Sociology of Religion
- E. Sociology of Science
- F. Sociology of Education
- G. Special Topics in Social Institutions and Processes

One course. *George, Gold, Lin, Maddox, or Weinberger*

227S, A-D. Proseminars in Medical Sociology. (SS) Selected topics in medical sociology.

- A. Social Structure and Health
- B. Social Behavior and Health
- C. Organization and Financing of Health Care
- D. Special Topics in Medical Sociology (for example, social epidemiology, stress and coping, health and aging)

One course. *George, Gold, Lin, Maddox, or Weinberger*

234S. Political Economy of Development: Theories of Change in the Third World. (SS) See C-L: Political Science 234S; also C-L: Comparative Area Studies, Cultural Anthropology 234S, History 234S, and Interdisciplinary Course 234S. One course. *Staff*

255. Political Sociology. (SS) Pluralist, elite, and class theories of the relationship between state and society. Topics include: recent debates on the welfare state, social control, political participation, and state-society relations in socialist economies. C-L: Canadian Studies and Political Science 255. One course. *Smith or Tiryakian*

282S. Canada. (SS) See C-L: History 282S; also C-L: Canadian Studies, Comparative Area Studies, Cultural Anthropology 282S, Economics 282S, Interdisciplinary Course 282S, and Political Science 282S. One course. *Cahow or Thompson*

298S, 299S. Seminar in Selected Topics. Substantive, theoretical, or methodological topics. One course each. *Staff*

COURSES CURRENTLY UNSCHEDULED

23S. Social Organization. (SS)

24S. Social History. (SS)

25S. Deviance. (SS)

140. Environment and Society. (SS)

THE MAJOR

Prerequisite. Sociology 10D or, under exceptional circumstances, an equivalent course (Sociology 11, 20S-25S, 49S) with the consent of the Director of Undergraduate Studies.

Major Requirements. Eight courses which must include 132, 133, and 138. Only one independent study credit can be applied to the major; it may not substitute for a required course. A student may complete a second major in sociology. Requirements and advising are the same for the second major as for the first major.

A *Handbook for Sociology Majors*, available in the office of the Director of Undergraduate Studies, describes areas of concentration, the honors program, and the Sociology Union. It also describes the departmental advising system and the interests of the faculty.

Institute of Statistics and Decision Sciences (STA)

Professor West, *Director*; Associate Professor Burdick, *Director of Undergraduate Studies*; Professors Berry, Sacks, and Winkler; Associate Professor Wolpert; Assistant Professors Johnson, Lavine, Müller, Parmigiani, and Stangl; Adjunct Professors Peterson and Wilkinson; Visiting Assistant Professors Erkanli, Herschkorn, Mukhopadhyay, and Vidakovic

The Institute of Statistics and Decision Sciences coordinates teaching and research in statistics and decision theory at Duke. It offers various courses in basic statistics and advanced mathematical statistics. The research emphasis on statistical decision theory in the institute leads to its offering a variety of courses, at various levels, in statistics and decision sciences. There is no undergraduate major in statistics. The institute maintains and runs a Statistical Consulting Center which provides help on statistical problems and projects for members of the Duke community.

10D. Basic Statistics. (QR) Statistical concepts involved in making inferences, decisions, and predictions from data. Emphasis on applications, not formal technique. Not open to students who have had Political Science 138, Psychology 117, Public Policy Studies 112, Sociology 133, or Statistics 110, 112, 113, 114, or 115. One course. *Staff*

104. Probability. (QR) Prerequisite: Mathematics 103. See C-L: Mathematics 135. One course. *Staff*

104S. Probability. (QR) Prerequisite: Mathematics 103. See C-L: Mathematics 135S. One course. *Staff*

110A. Statistics and Data Analysis in the Social Sciences. (QR) Descriptive statistics. Probability and its role in statistical inference. Confidence intervals. Tests of significance. Introduction to linear regression modeling. Not open to students who have

had Mathematics 136 or Statistics 110B, 112, 113, 114, 210A, 210B, or 213. One course. *Staff*

110B. Statistics and Data Analysis in Economics. (QR) Descriptive statistics. Probability and its role in statistical inference. Confidence intervals. Tests of significance. Introduction to linear regression modeling. Emphasis on applications in economics. Not open to students who have had Mathematics 136, Statistics 110A, 112, 113, 114, 210A, 210B, or 213. One course. *Staff*

112. Introduction to Applied Statistics. (QR) Classical techniques of testing and estimation. Emphasis on applications of the theory to applied problems. Not open to students who have taken Statistics 213 or equivalent. Prerequisite: Mathematics 103 (may be taken concurrently) or equivalent, or consent of instructor. One course. *Staff*

113. Probability and Statistics in Engineering. (QR) Introduction to probability, independence, conditional independence, and Bayes' theorem. Discrete and continuous, univariate and multivariate distributions. Linear and nonlinear transformations of random variables. Classical and Bayesian inference, decision theory, and comparison of hypotheses. Experimental design, statistical quality control, and other applications in engineering. Not open to students who have taken Statistics 112 or 213. Prerequisite: Mathematics 103 or equivalent. One course. *Staff*

114. Statistics. (QR) Prerequisites: Mathematics 104 and 135. See C-L: Mathematics 136. One course. *Staff*

191, 192. Independent Study. Directed reading and research. Consent of instructor and Director of Undergraduate Studies required. One course each. *Staff*

203S. Senior Seminar in Statistics. (QR) Illustrative list of past topics: empirical applications of classical and Bayesian methods; robustness and model specification; time series analysis; applications of probability theory. Prerequisite: Mathematics 136, Statistics 114, or Statistics 213. One course. *Staff*

205. Probability and Measure Theory. (QR) Introduction to probability spaces, the theory of measure and integration, random variables, and limit theorems. Distribution functions, densities, and characteristic functions; convergence of random variables and of their distributions; uniform integrability and the Lebesgue convergence theorems. Weak and strong laws of large numbers, central limit theorem. Prerequisites: elementary real analysis and elementary probability theory. One course. *Wolpert*

207. Probability. (QR) Prerequisite: Mathematics 281 or equivalent. See C-L: Mathematics 290. One course. *Staff*

210A. Statistics and Data Analysis for Policymakers. (QR) Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. Emphasis on public policy applications. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210B, or 213. C-L: Public Policy Studies 222. One course. *Staff*

210B. Statistics and Data Analysis in Biological Science. (QR) Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. Emphasis on biological science applications. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210A, or 213. C-L: Environment 251. One course. *Staff*

213. Introduction to Statistical Methods. (QR) Emphasis on classical techniques of hypothesis testing and point and interval estimation, using the binomial, normal, t, F, and chi square distributions. Not open to students who have had Statistics 114 or Mathematics 136. Prerequisite: Mathematics 103 (may be taken concurrently) or equivalent, or consent of instructor. One course. *Pole*

214. Probability and Statistical Models. (QR) An introduction to applied probability and to the parametric probability models commonly used in statistical analysis. The generation of random variables with specified distributions, and their use in simulation. Mixture models; linear regression models; random walks, Markov chains, and stationary and ARMA process; networks and queueing models. Prerequisites: Mathematics 103 and 104 or consent of instructor. One course. *Staff*

215. Statistical Inference. (QR) Classical, likelihood, and Bayesian approaches to statistical inference. Foundations of point and interval estimation, and properties of estimators (bias, consistency, efficiency, sufficiency, robustness). Testing: Type I and II errors, power, likelihood ratios; Bayes factors, posterior probabilities of hypotheses. The predictivist perspective. Applications include estimation and testing in normal models, exponential families, regression and one-way ANOVA, contingency tables. Hierarchical normal models; model choice and criticism. Prerequisite: Statistics 213 or co-registration in Statistics 214 or consent of instructor. One course. *Staff*

216. Generalized Linear Models. (QR) Likelihood-based inference in generalized linear models (GLIMs). Multiple linear regression, theory, and practice. Elements of Bayesian analyses of linear models. Theory of likelihood-based inference for GLIMs. Factor variables and cross-classified data arrays. Discrete models: binary regressions and simple contingency tables. Introduction to log-linear models. Data analysis: model fitting, model choice, and residuals-based diagnostics. Prerequisite: Statistics 215 or equivalent. One course. *Johnson*

226. Statistical Decision Theory. (QR) Formulation of decision problems; criteria for optimality: maximum expected utility and minimax. Axiomatic foundations of expected utility; coherence and the axioms of probability (the Dutch Book theorem). Elicitation of probabilities and utilities. The value of information. Estimation and hypothesis testing as decision problems: risk, sufficiency, completeness and admissibility. Stein estimation. Bayes decision functions and their properties. Minimax analysis and improper priors. Decision theoretic Bayesian experimental design. Combining evidence and group decisions. Prerequisite: Statistics 215 or consent of instructor. One course. *Staff*

242. Applied Regression Analysis. (QR) Regression analysis with nonexperimental data using ordinary least squares. Emphasis on assumption violations: consequences and correctives. Analysis of variance. Time series analysis. Prerequisite: Statistics 210 or equivalent. One course. *Johnson*

244. Linear Models. (QR) Multiple linear regression. Estimation and prediction. Likelihood, Bayesian, and geometric methods. Analysis of variance and covariance. Residual analysis and diagnostics. Model building, selection, and validation. Prerequisites: Mathematics 104 and Statistics 113 or 210. C-L: Mathematics 241. One course. *Staff*

245. Introduction to Multivariate Statistics. (QR) Multinormal distributions, multivariate general linear model, Hotelling's T^2 statistic, Roy union-intersection principle, principal components, canonical analysis, factor analysis. Prerequisite: Statistics 244 or equivalent. C-L: Mathematics 242. One course. *Burdick*

246. Experimental Design. (QR) Randomization, blocks, factors, and treatments; random and fixed effects; fractional factorial, Latin squares, and other designs; estimation and testing; optimal design and allocation; informational design. Prerequisites: Statistics 213 and 244 or equivalent. One course. *Staff*

253. Applied Stochastic Processes. (QR) Prerequisite: Mathematics 135 or equivalent. See C-L: Mathematics 240. One course. *Staff*

265. Econometrics II. (QR) Prerequisite: Economics 243 or equivalent. See C-L: Economics 245. One course. *Tauchen*

266. Econometrics III. (QR) Prerequisite: Economics 245. See C-L: Economics 246. One course. *Gallant and Tauchen*

273. Numerical Analysis. (QR) Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. See C-L: Computer Science 221; also C-L: Mathematics 221. One course. *Gardner or Greenside*

282. Optimization Methods. (QR) Introductory survey of optimization techniques useful in management and social decision making. Numerical techniques for unconstrained optimization, linear and dynamic programming, and optimal control methods. Consent of instructor required. One course. *Wolpert*

290. Case Studies in Applied Statistics. (QR) Data management and collection, sampling and design, exploratory data analysis, graphical and tabular displays, summarizing data. Case studies from various disciplines such as biostatistics, economics, medical decision making, engineering, and business administration presented by various faculty members. Introduction to applied work through workshops, consultancy, and research literature. Computer orientation, statistical packages and operating systems, graphics, and numerical computing. May be taken more than once. One course. *Staff*

293. Special Topics in Statistics. (QR) Advanced topics in analysis of variance, design of experiments, nonparametric statistics, foundations of statistical inference. Prerequisite: Statistics 213 or consent of instructor. One course. *Staff*

297. Topics in Probability Theory. Prerequisite: Mathematics 290 or consent of instructor. See C-L: Mathematics 293. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

30. Introduction to Decision Analysis. (QR)

31. Applied Game Theory. (QR)

115. Statistical Data Analysis in Engineering. (QR)

294. Special Topics in Statistics. (QR)

298. Topics in Probability Theory

Swahili

For courses in Swahili, see Asian and African Languages and Literature.

University Writing Program (UWC)

Professor of the Practice Gopen, *Director*; Assistant Professor of the Practice Hillard, *Assistant Director*

The writing requirement may be fulfilled by successfully completing University Writing Course 4, 5, 6, 7, or 8, each of which involves expository themes and regular individual conferences. The requirement must be fulfilled in a student's first semester of residence at Duke. Despite the distinction in titles and topics, all these courses deal with the same core concerns and have the same objective: they are intended to help students of all abilities to a greater understanding of the language and thereby to a greater control of their thinking process.

3. Introductory Composition and Rhetoric. A preparatory course in composition, with frequent writing assignments and regular individual conferences. Offered in the summer term Preview Program; does not satisfy the requirement for proficiency in writing. One course. *Staff*

4. Principles of Writing. Designed for those who feel less confident than they would like about their writing. Principles of clear, sophisticated, college-level prose. Essays on a variety of topics. One course. *Staff*

5. Persuasive Writing. Differs from University Writing Course 4 in only three ways: (1) the essays in each course section are based on a single topic, the readings for which are primarily nonfiction; (2) the class size is slightly larger; and (3) the pace may be somewhat faster. One course. *Staff*

7. Writings on Special Topics. Themes and readings vary with the topic of each section. Enrollment restricted to students in specified programs. One course. *Staff*

8. Expository and Persuasive Writing. This course, which covers the rhetorical principles available in University Writing Course 4, 5, 6, and 7, is offered only in the spring. The readings vary with the individual instructors. Not open to students who have passed 4, 5, 6, or 7. One course. *Staff*

12. Intermediate Composition. For transfer students only. The approach to evaluating written language that is taught in the University Writing Program. Not open to students who have taken University Writing Course 4, 5, 6, 7, or 8. One course. *Staff*

112. Scientific Writing. Advanced composition for those who will be choosing careers in science. Techniques for presenting complicated data and complex thought in clear and persuasive prose. Readings in the history, philosophy, or theory of science. Weekly writing tasks. Prerequisite: University Writing Course 4, 5, 6, or 7. C-L: English 116A. One course. *Staff*

117S. Advanced Composition I. Emphasis on the connections between substance and structure; revision techniques and inventional procedures. Tailored to the level, needs, and interests of students who enroll. Prerequisite: previous University Writing Course or consent of the director of the University Writing Program. C-L: English 117A. One course. *Staff*

118S. Advanced Composition II. Emphasis on preparing prose for publication, in whatever fields interest the participating students. Prerequisite: successful completion of University Writing Course 117S. C-L: English 117B. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

6. Interpretive Writing

For other courses in writing, see listings for Department of English.

Women's Studies Program (WST)

Professor of the Practice and Adjunct Professor J. O'Barr, *Director*; Professor Hamilton

A certificate, but not a major, is available in this program.

The program in women's studies provides for students an understanding of the forces that shape the position of women in society and develops an appreciation for knowledge about women and gender. Women's studies brings together faculty and students from many disciplines who share an interest in studying women's experiences and who incorporate ideas and information about these experiences into research, teaching, and learning. Women's studies encourages students to question and reinter-

pret existing bodies of information and theories and to include women's perspectives and contributions in the new interpretation.

Courses in women's studies, open to all Duke students, are offered through a number of academic departments and through the women's studies designation. The certificate, representing an area of concentration supplementing but not replacing a major, is available to all students in the program who meet the requirements listed below. Students working toward the certificate declare a major outside the program and utilize women's studies as a valuable additional area of academic concentration.

To earn a certificate, students take a minimum of five women's studies courses. Those courses come from three categories: (1) Core Courses (students must take Women's Studies (WST) 103, An Introduction to Women's Studies); (2) Courses on Women/Gender (students must take at least three courses, one from the Social Sciences (SS) area of knowledge, a second from either the Arts and Literature (AL) or Civilizations (CZ) area of knowledge, and the third from any of the six areas); (3) Courses on Women in Relation to Culture and Society (students must take at least one course, which may come from any of the six areas of knowledge). Women's Studies 195S, Senior Seminar in Women's Studies, is offered every spring, and may be taken in place of Women's Studies 103 (with the director's approval) if the student has completed several courses in women's studies prior to the senior year. The senior seminar is also strongly recommended as a sixth course for students earning the certificate. With approval of the director, one independent study course (taken at Duke or abroad) may count toward the certificate. Students intending to earn the certificate should make an appointment to speak with the undergraduate advisor in the Women's Studies Program office.

Students earning the undergraduate certificate are eligible for graduation with distinction in women's studies. Guidelines for honors in women's studies are available in the program office.

The courses listed below are offered regularly and can be used to fulfill the requirements for the certificate. For a more detailed description of each course, consult the listing in the appropriate department or contact the Women's Studies Program Office.

103. An Introduction to Women's Studies. (SS) Gender roles, their place in American culture, and the twentieth-century feminist movement. Use of the perspectives of the social sciences, the natural sciences, and the humanities. Emphasis on integrating the study of women, women's history, experience, and modes of expression into the traditional disciplines. One course. *J. O'Barr and staff*

150. Selected Topics in Women's Studies. Topics vary, focusing on interdisciplinary work arising from feminist scholarship. One course. *Staff*

191, 192. Independent Study. Consent of instructor and program director required. One course each. *Staff*

195S. Senior Seminar in Women's Studies. Original research project in feminist scholarship, applying multidisciplinary perspectives. For Women's Studies Program certificate earners. Consent of instructor required. One course. *Staff*

REGULARLY SCHEDULED COURSES

Core Courses

Women's Studies 103. An Introduction to Women's Studies. *J. O'Barr and staff*

Women's Studies 150. Selected Topics in Women's Studies. *Staff*

Women's Studies 191, 192. Independent Study. *Staff*

Women's Studies 195S. Senior Seminar in Women's Studies. *J. O'Barr and staff*

Courses on Women/Gender

Art 186. Feminism in Twentieth-Century Art. *Stiles*

Classical Studies 104S. Women in the Ancient World. *Boatwright*

Contemporary Theology 139. Women in Ministry. *McClintock-Fulkerson*

Cultural Anthropology 113. The Cultural Construction of Gender. *Allison or Quinn*
 Cultural Anthropology 114. Gender Inequality. *Allison, Quinn, or Starn*
 Cultural Anthropology 215. The Anthropology of Women: Theoretical Issues. *Staff*
 English 269. American Women Writers. *C. Davidson, Pope, or Tompkins*
 French 108S. French Women: Myths, Realities, and the Law. *Staff*
 French 157. Difference and Representation. *Schor*
 French 159. Feminist Fiction. *Orr*
 German 254S. Literature by Women. *Rasmussen*
 German 275S. German Women Writers. *Rasmussen*
 History 169A, 169B. The Social History of American Women. *Hewitt and staff*
 History 171A. History of Women in Early Modern Europe. *Neuschel*
 History 171B. History of Women in Modern Europe. *Koonz*
 History 190. The History of Women in Science and Medicine. *Green*
 Italian 105. Italian Women Writers. *Finucci*
 Literature 134S. Women in Jewish Literature. *Zucker*
 Literature 136. Autobiography across Cultures. *Kaplan or Willis*
 Literature 151. Special Topics in Women Writers of the World. *Staff*
 Literature 254. Introduction to Feminism. *Moi or Radway*
 Music 120S. Women in Music. *Staff*
 Philosophy 122. Philosophical Issues in Feminism. *Lind*
 Philosophy 203S. Contemporary Ethical Theories. *Lind*
 Political Science 163. Gender, Politics, and Policy: The Third World Case. *J. O'Barr*
 Psychology 164S. Psychology of Women. *Hamilton or Roth*
 Religion 109. Women in the Biblical Tradition: Image and Role. *C. Meyers*
 Religion 125. Women and Sexuality in the Christian Tradition. *Clark*
 Religion 253. Feminist Theory and the Study of Christianity. *Clark and McClintock-Fulkerson*
 Russian 169/269. Women and Russian Literature. *Gheith*
 Sociology 118. Sex, Gender, and Society. *O'Rand*
 Sociology 149. Sexuality and Society. *Luttrell*

Courses on Women in Relation to Culture and Society

Cultural Anthropology 110. Advertising and Society. *Luttrell or W. O'Barr*
 Cultural Anthropology 137. From Incest to Adultery: Anthropological Explorations of Kinship and Marriage. *Quinn*
 Cultural Anthropology 252S. American Marriage: A Cultural Approach. *Quinn*
 Economics 208S. Economics of the Family. *McElroy*
 English 156. American Popular Culture. *Radway or Willis*
 English 187. Melodrama and Soap Opera. *Gaines*
 History 107A, 107B. History of England. *Herrup or Thorne*
 History 115. History of Africa. *Ewald*
 History 117. Early Modern Europe. *Neuschel*
 History 160. The United States from the New Deal to the Present. *Chafe*
 History 227-228. Recent United States History: Major Political and Social Movements. *Chafe*
 Literature 177. Film Theory. *Gaines*
 Literature 185. Psychoanalysis, Literature, and Film. *Gaines*
 Political Science 129. Political Participation. *Paletz*
 Political Science 153, 154. Politics and the Media of Mass Communication. *Paletz*
 Political Science 187S. Politics and the Libido. *Paletz*
 Public Policy Studies 278. Human Service Bureaucracies. *Malson*
 Religion 234. Early Christian Asceticism. *Clark*
 Sociology 106. Social Psychology. *Fischer or George*
 Sociology 111. Inequality in America. *O'Rand*
 Sociology 150. The Changing American Family. *Simpson*
 Sociology 161. Adulthood and Aging. *George, Gold, or O'Rand*
 Sociology 165. Occupations, Professions, and Careers. *O'Rand, Simpson, or Spenner*
 Spanish 166. Nineteenth-Century Prose Fiction. *Sieburth*

OTHER PERTINENT COURSE OFFERINGS

In addition to the regular courses listed above, the following sections of general courses are offered by women's studies faculty members in various departments. These sections focus specifically on topics relevant to women; they count toward the women's studies certificate requirements only when offered on these specific topics by the women's studies faculty members listed here. Also, house courses, taken for half credit through Duke dormitories, are frequently offered and sponsored through the Women's Studies Program.

Courses on Women/Gender

Classical Studies 195S, 196S. Sex Roles in Antiquity. *Boatwright*
English 109S. Topics in Women's Poetry. *Pope*
English 169S. Twentieth-Century Popular American Women's Writing. *Tompkins*
English 179S. Portraits of the Lady: Studies in the Literary Images of Women. *Pope*
English 179S. Studies in Women's Fiction. *Pope*
English 179S. Writings by Women of Color. *Willis*
French 104S. Women in Contemporary France. *Orr*
French 290S. Studies in a Contemporary Figure: *Orr*
German 124S. Contemporary German Women Writers. *Rasmussen*
History 195S.05. Japanese Women's History. *Wigen*
History 195S.41. Women in Medieval Society. *Green*
History 195S.50. History of Feminism in the U.S. *Hewitt*
History 221. Topics in the Social and Economic History of Europe, 1200-1700. *Neuschel*
Political Science 200S A.18. Contemporary American Feminism. *J. O'Barr*
Public Policy Studies 195S/264S. Gender and Social Policy. *Malson*
Spanish 141S. Spanish-American Women Writers. *Ross*

Courses on Women In Relation to Culture and Society

English 139S. Politics of Gender. *DeNeef*
English 154. American Literature: 1915-1960. *Pope*
English 163. Twentieth-Century American Poetry. *Pope*
English 189S. Sexualities in Film and Literature. *Gaines*
English 288. The Western in American Culture. *Tompkins*
French 166, 167. Contemporary French Life and Thought. *Kaplan*
Public Policy Studies 195S/264S. Family Policy. *Malson*
Public Policy Studies 195S. Poverty and Dependency. *Malson*
Public Policy Studies 264S. Poverty and Public Policy. *Malson*

In addition to offering courses and a certificate representing a concentration in women's studies, the Women's Studies Program sponsors lectures, films, discussions, conferences, and internships that focus on women's issues. It provides academic advice and assistance to students earning certificates in the program. Additional information on courses, the women's studies certificate, and other opportunities in women's studies is available at the Women's Studies Program Office, 207 East Duke Building.

Writing

See University Writing Program.

Zoology (ZOO)

Professor H. Nijhout, *Chair*; Professors Barber, Brandon, Fluke, Forward, Gillham, Klopfer, Laurie, Livingstone, McClay, Nicklas, Rausher, Simons, Staddon, Sutherland, Terborgh, Tucker, Uyenoyama, Vogel, Wainwright, and Ward; Associate Professors Rittschof, Roth, and K. Smith; Assistant Professors Crenshaw, Fehon, Morris, and Nowicki; Professors Emeriti Bailey, Bookhout, Gregg, Schmidt-Nielsen, and K. Wilbur; Assistant Professor of the Practice Motten; Research Assistant Professor Roach; Adjunct Professor Schmidt-Koenig; Adjunct Associate Professor M. Nijhout; Instructor Mercer

See Biology for a description of the major and the list of courses taught by the zoology faculty.

School of Engineering

Professor Dowell, *Dean*; Professor Shepard, *Associate Dean*

ENGINEERING

(INTERDEPARTMENTAL) (EGR)

24L. Environmental Engineering Science. Materials and energy balances applied to environmental engineering problems. Water pollution control, applied ecology, air

quality management, solid and hazardous waste control. Environmental ethics. (1.0 ES)
Prerequisite: Chemistry 11L. One course. *Peirce or Vesilind*

25L. Structural Engineering Design. An introduction to engineering and the engineering method through a wide variety of historical and modern case studies, ranging from unique structures like bridges to mass produced objects like pencils. (.5 ED / .5 ES)
One course. *Petroski*

49S. First-Year Seminar. Topics vary each semester offered. One course. *Staff*

50. Introduction to Numerical Computing. Introduction to the use of computers in the solution of engineering and scientific problems. Systematic methods for algorithm development and coding in a higher-level computer language. Application of selected numerical methods. Not open to students who have matriculated at Duke. One course.
Pas

53L. Computational Methods in Engineering. Introduction to computer methods and algorithms for analysis and solution of engineering problems using numerical methods in a workstation environment. Topics include; numerical integration, roots of equations, simultaneous equation solving, finite difference methods, matrix analysis, linear programming, dynamic programming, and heuristic solutions used in engineering practice. This course includes instruction in the programming language FORTRAN and does not require any prior knowledge of computer programming. (1.0 ES) One course. *Staff*

75L. Mechanics of Solids. Analysis of force systems and their equilibria as applied to engineering systems. Stresses and strains in deformable bodies; mechanical behavior of materials; applications of principles to static problems of beams, torsion members, and columns. Selected laboratory work. (1.0 ES) Prerequisites: Physics 51L and Mathematics 32. One course. *Hueckel, Petroski, or J. F. Wilson*

83L. Structure and Properties of Solids. Introduction to materials science and engineering, emphasizing the relationships between the structure of a solid and its properties. Atomic and molecular origins of electrical, mechanical, and chemical behavior are treated in some detail for metals, alloys, polymers, ceramics, glasses, and composite materials. (.25 ED / .75 ES) Prerequisites: Chemistry 11L and Mathematics 31 or 33. One course. *Cocks, Gösele, Jones, Needham, Shepard, or Tan*

115. Engineering Systems Optimization. Introduction to mathematical optimization, engineering economic analysis, and other decision analysis tools used to evaluate and design engineering systems. Application of linear and nonlinear programming, dynamic programming, expert systems, simulation and heuristic methods to engineering systems design problems. Applications discussed include: production plant scheduling, water resources planning, design and analysis, vehicle routing, resource allocation, repair and rehabilitation scheduling and economic analysis of engineering design alternatives. (.5 ED / .5 ES) Corequisite: Mathematics 111. One course. *Jacobs*

123L. Dynamics. Principles of dynamics of particles, rigid bodies, and selected nonrigid systems with emphasis on engineering applications. Kinematic and kinetic analysis of structural and machine elements in a plane and in space using graphical, computer, and analytical vector techniques. Absolute and relative motion analysis. Work-energy; impact and impulse-momentum. Laboratory experiments. (1.0 ES) Prerequisites: Mathematics 103 and Engineering 75L or consent of instructor. One course.
Petroski or J. F. Wilson

150L. Engineering Communication. Principles of written and verbal technical communication; graphics, mapping, surveying and engineering drawing. Computer graphics, two- and three-dimensional transformations, hidden-surface and hidden-line

algorithms, and computer aided design. (1.0 ES) Prerequisite: Engineering 53L or equivalent. One course. *Pas and Vesilind*

165. Special Topics in Engineering. Study arranged on special engineering topics in which the faculty have particular interest and competence as a result of research or professional activities. Consent of instructor(s) required. Quarter course, half course, or one course. Variable credit. *Staff*

174. Technology Assessment and Social Choice. Societal, economic, environmental, psychological, and ethical considerations in the design and application of technological systems; techniques for technological forecasting and assessment; citizen participation in policy-making; recent case studies; interdisciplinary team project. C-L: Religion 174. One course. *Garg and McCollough*

175. Aesthetics, Design, and Culture. An examination of the role of aesthetics, both as a goal and as a tool, in a culture which is increasingly dependent on technology. Visual thinking, perceptual awareness, experiential learning, conceptual modeling, and design will be explored in terms of changes in sensory environment. Design problems will be formulated and analyzed through individual and group design projects. (.5 ED) One course. *Pearsall*

183, 184. Projects in Engineering. Courses in which engineering projects of an interdisciplinary nature are undertaken. The projects must have engineering relevance in the sense of undertaking to meet human need through a disciplined approach under the guidance of a member of the engineering faculty. Consent of instructor required. One course each. *Staff*

221. Computational Linear Algebra. Linear vector spaces of real and complex n-tuples, norms, metrics, inner-products, basis vectors, rank and dimensionality; matrices as linear maps, rank and nullity, particular and general solutions of $Ax=b$; factorization of matrices by successive transformations; solution of $Ax=b$ by direct and iterative methods; special and general eigenvalue problems; diagonalization and tridiagonalization by similarity transformations; power methods, computational complexities, storage requirements, convergence characteristics, error propagation, and the mathematical basis of the studied algorithms. (1.0 ES) Prerequisites: Mathematics 111 or equivalent, and knowledge of any algorithmic programming language. One course. *S. Utku*

COURSES CURRENTLY UNSCHEDULED

23. Principles and Practices in Engineering Economics

135. Continuum Mechanics

151. Computer Simulations in Engineering

170. Forecasting Techniques

172A. Contemporary Science: Issues and Challenges

172B. Contemporary Technology: Issues and Challenges

187. History of Nuclear Energy: Civilian Applications

188. History of Nuclear Energy: Military Applications

222. Computer Solutions of Ordinary and Partial Differential Equations

Biomedical Engineering (BME)

Professor McElhaney, *Chair*; Professor S. Smith, *Director of Undergraduate Studies*; Professors Barr, Clark, Hammond, Hochmuth, Ideker, Jaszczak, Nolte, Plonsey, von Ramm,

and Wolbarsht; Associate Professors Burdick, Feagin, Floyd, Needham, Pasipoularides, Reichert, W. Smith, and Trahey; Assistant Professors Clegg, Glower, Hales, Henriquez, Krassowska, Myers, P. Smith, and Truskey; Research Professor Thurstone; Research Assistant Professors Blanchard, Bohs, Cusma, Eyuboglu, Jacobs, Knisley, Rasmusson, M. Smith, Stetten, and Wolf; Adjunct Associate Professor Cooper

A major is available in this department.

Biomedical engineering is the discipline in which the physical, mathematical, and engineering sciences and associated technology are applied to biology and medicine. Contributions range from modeling and simulation of physiological systems through development of medical instrumentation and experimental research to solutions of practical clinical problems. The undergraduate program in biomedical engineering is flexible and can satisfy the requirements for entrance into graduate work in engineering, medicine, and other professional schools or science disciplines.

Opportunities for student research are available in the biomedical engineering laboratories. The department utilizes digital computers extensively, and computer science techniques are applied in acquiring, processing, and modeling biological data. Research in the biomedical materials laboratory is directed toward the development of materials suitable for use in biological environments such as the vascular system. Biomedical engineering in cardiology involves study of the electrical activity of the heart and heart tissues in animals and humans, to increase the basic knowledge of their normal and abnormal behavior. Other electrophysiological systems are examined through the application of models and simulation techniques. The ultrasound imaging laboratories are employed for research and instruction in the biomedical application of this important technique. Ultrasound instrumentation measures and images biological tissue structures, and the laboratories are equipped with a variety of advanced ultrasonic imaging instruments. A transducer fabrication facility, test equipment for the design and construction of advanced ultrasound systems, a dedicated VAX 4300 computer and a DECstation 3100 for image processing, and extensive video recording and display facilities are available. Other areas of research and instruction include biosensors and vascular implants. The biomechanics laboratory is equipped to measure biomechanical responses of tissues and organs and gait parameters, and to test protective headgear and develop new prosthetic devices.

Additional opportunities are available in biological fluid mechanics, lipid transport mechanisms, and biosensors.

7. Membranes. An introduction to the elementary properties of membranes, both electrical and mechanical from a mathematical perspective, with some computer exercises. Intended for freshmen who are prospective biomedical engineering majors. (.5 ED/.5 ES) One course. *Barr or Plonsey*

83. Introduction to Biomaterials. The principles of materials science and engineering with particular attention to topics most relevant to biomedical engineering. The structure-property relationships of metals, ceramics, polymers, and composites as well as skin, bone, cartilage, ligament, and vasculature; extensive treatment of the properties unique to materials' surfaces. Behavior of materials in the physiological environment. Fall only. (.25 ED/.75 ES) Prerequisites: Chemistry 11L and 12L; corequisite: Physics 51L. One course. *Reichert*

101L. Electrobiology. The electrophysiology of excitable cells from a quantitative perspective. Topics include the ionic basis of action potentials, the Hodgkin-Huxley model, impulse propagation, source-field relationships, and an introduction to functional electrical stimulation. (.25 ED/.75 ES) Prerequisites: Biomedical Engineering 163 or Electrical Engineering 62, and Mathematics 111. One course. *Barr or Henriquez*

110L. Introductory Biomechanics. Static and dynamic analysis of biological systems; analysis of gait and locomotion; ballistocardiography; biomechanical aspects of

various sport activities, diving, and jumping; power, work, and energy concepts applied to the human body; strength and properties of tissue; and injury mechanisms and tolerance. (.25 ED / .75 ES) Prerequisites: Mathematics 32 and Physics 51L. One course. *McElhaney or Myers*

145. Chemical Thermodynamics. Thermodynamic properties and thermodynamic state. Exchange of heat and work in quasi-equilibrium processes. Chemical and phase equilibria of multicomponent mixtures. (.25 ED / .75 ES) Prerequisite: junior standing. One course. *Clark or Truskey*

163L, 164L. Biomedical Electronics and Measurements. A study of the basic principles of biomedical electronics and measurements with emphasis on the operational performance and selection of transducers, instruments, and systems for biomedical data acquisition and processing. Selected laboratory work emphasizes the measurements of specific physiological events. (.5 ED / .5 ES each) Prerequisite: Electrical Engineering 61L. One course each. *S. Smith, Trahey, or von Ramm*

171. Signals and Systems. Convolution, deconvolution, Fourier series, Fourier transform, sampling, and the Laplace transform. Continuous and discrete formulations with emphasis on computational and simulation aspects and selected biomedical examples. (1.0 ES) One course. *Staff*

191, 192. Projects in Biomedical Engineering. For seniors who express a desire for such work and who have shown aptitude for research in one area of biomedical engineering. Half course to two courses. (.5 ED / .5 ES) Variable credit. *Staff*

193, 194, 195. Projects in Cardiovascular Biomedical Engineering. Projects in Emerging Cardiovascular Technologies. Primarily for Engineering Research Center Fellows who express a desire for and who have shown aptitude for research in emerging cardiovascular technologies. Consent of instructor required. (.5 ED / .5 ES) One course each. *Staff*

201L. Electrophysiology. The electrophysiology of excitable cells from a quantitative perspective. Topics include the ionic basis of action potentials, the Hodgkin-Huxley model, impulse propagation, source-field relationships, and an introduction to functional electrical stimulation. Students choose a relevant topic area for detailed study and report. Not open to students who have taken Biomedical Engineering 101 or equivalent. 3 units; 4 units with laboratory. (.25 ED / .75 ES) One course. *Barr or Henriquez*

205L. Microprocessors and Digital Instruments. Design of microcomputer-based devices including both hardware and software considerations of system design. Primary emphasis on hardware aspects, including a progression through initial design, prototype construction in the laboratory, testing of prototypes to locate and correct faults, and final design evaluation. Evaluation includes examination of complexity, reliability, and cost. Design and construction oriented toward biomedical devices or instruments that include dedicated microcomputers, usually operating in real time. (.75 ED / .25 ES) Prerequisites: Engineering 51L and Biomedical Engineering 163L, 164L or equivalents. One course. *Barr or Hammond*

207. Transport Phenomena in Biological Systems. (.25 ED / .75 ES) See C-L: Biochemical Engineering 207; also C-L: Civil Engineering 207 and Mechanical Engineering 207. One course. *Truskey*

208. Theoretical and Applied Polymer Science. (.6 ED / .4 ES) See C-L: Mechanical Engineering 211. One course. *Clark*

209. Kinetics and Reactor Design. (.5 ED / .5 ES) Prerequisite: Mathematics 111 or consent of instructor. See C-L: Biochemical Engineering 209; also C-L: Civil Engineering 209. One course. *Staff*

211. Theoretical Electrophysiology. Advanced topics on the electrophysiological behavior of nerve and striated muscle. Source-field models for single-fiber and fiber bundles lying in a volume conductor. Forward and inverse models for EMG and ENG. Bidomain model. Model and simulation for stimulation of single-fiber and fiber bundle. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. (.5 ED/.5 ES) Prerequisite: Biomedical Engineering 101 or 201. One course. *Barr or Plonsey*

212. Theoretical Electrocardiography. Electrophysiological behavior of cardiac muscle. Emphasis on quantitative study of cardiac tissue with respect to propagation and the evaluation of sources. Effect of junctions, inhomogeneities, anisotropy, and presence of unbounded extracellular space. Bidomain models. Study of models of arrhythmia, fibrillation, and defibrillation. Electrocardiographic models and forward simulations. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. (.5 ED/.5 ES) Prerequisite: Biomedical Engineering 101 or 201. One course. *Barr or Plonsey*

215. Biomedical Materials and Artificial Organs. Chemical structures, processing methods, evaluation procedures, and regulations for materials used in biomedical applications. Applications include implant materials, components of ex vivo circuits, and cosmetic prostheses. Primary emphasis on polymer-based materials and on optimization of parameters of materials which determine their utility in applications such as artificial kidney membranes and artificial arteries. (.5 ED/.5 ES) Prerequisite: Engineering 83L or Chemistry 151L or consent of instructor. C-L: Mechanical Engineering 215. One course. *Clark or Reichart*

216. Transport Phenomena in Cells and Organs. (.5 ED/.5 ES) Prerequisite: Biomedical Engineering 207 or equivalent. See C-L: Biochemical Engineering 216. One course. *Truskey*

222. Principles of Ultrasound Imaging. Propagation, reflection, refraction, and diffraction of acoustic waves in biologic media. Topics include geometric optics, physical optics, attenuation, and image quality parameters such as signal-to-noise ratio, dynamic range, and resolution. Emphasis is placed on the design and analysis of medical ultrasound imaging systems. (.5 ED/.5 ES) Prerequisites: Physics 52L and Mathematics 111. One course. *von Ramm*

223. Cellular and Integrative Cardiovascular Physiology and Biophysics. Electrical and mechanical properties of the heart at the cellular and organ levels; reflex control of cardiac output; the heart as an endocrine organ; interaction between heart, kidney, and lung; comparative cardiac physiology. Prerequisites: Cell Biology 203 or equivalent and Physics 52L or equivalent; consent of instructor or graduate status. C-L: Cell Biology 223. One course. *Benjamin and staff*

230. Biomechanics. Kinematic models of human motions, mechanical properties of bone and soft tissues, load directed growth mechanisms, human tolerance to impact and vibration, head injury criteria applied to helmet design. (.5 ED/.5 ES) One course. *McElhaney*

231. Orthopaedic Biomechanics. Biomechanics of hard and soft tissues: nonlinear viscoelastic behavior of tendon and ligament; poroelastic behavior of cartilage and meniscus; continuum modeling of bone. Emphasis will be placed on experimental techniques used to evaluate these tissues. Student seminars on topics in applied biomechanics will be included. (.5 ED/.5 ES) Prerequisites: Biomedical Engineering 110L or Engineering 75L or equivalent, and Biomedical Engineering 83 or Engineering 83L or equivalent. One course. *Myers*

233. Modern Diagnostic Imaging Systems. The underlying concepts and instrumentation of several modern medical imaging modalities. Review of applicable linear systems theory and relevant principles of physics. Modalities studied include X-ray radiography (conventional film-screen imaging and modern electronic imaging), computerized tomography (including the theory of reconstruction), and nuclear magnetic resonance imaging. Consent of instructor required. (.5 ED/ .5 ES) One course. *Cusma or Floyd*

235. Acoustics and Hearing. The generation and propagation of acoustic (vibrational) waves and their reception and interpretation by the auditory system. Topics under the heading of generation and propagation include free and forced vibrations of discrete and continuous systems, resonance and damping, and the wave equation and solutions. So that students may understand the reception and interpretation of sound, the anatomy and physiology of the mammalian auditory system are presented; and the mechanics of the middle and inner ears are studied. (.5 ED/ .5 ES) Prerequisites: Physics 52L and Mathematics 111 or equivalents. One course. *Trahey*

237. Biosensors. Biosensors defined as the use of biospecific recognition mechanisms in the detection of analyte concentration. The basic principles of protein binding with specific reference to enzyme-substrate, lectin-sugar, antibody-antigen, and receptor-transmitting binding. Simple surface diffusion and absorption physics at surfaces with particular attention paid to surface binding phenomena. Optical, electrochemical, gravimetric, and thermal transduction mechanisms which form the basis of the sensor design. (.5 ED/ .5 ES) Prerequisites: Biomedical Engineering 215 and consent of instructor. C-L: Biochemical Engineering 237. One course. *Reichert*

241. Artificial Intelligence in Medicine. Basic concepts of artificial intelligence (AI) and in-depth examination of medical applications of AI. Knowledge of heuristic programming; brief examination of classic AI programming languages (LISP and PROLOG) and AI programming; rule-based systems and cognitive models. (.5 ED/ .5 ES) One course. *Hammond*

244. Mathematical Models of Physiological Systems. Mathematical modeling and computer simulation of physiological and other biomedical systems. Formulation of quantitative models of physiological processes using methods drawn from a variety of engineering disciplines including transport phenomena, feedback control, and continuum mechanics. Digital techniques for the solution of coupled nonlinear equations, emphasizing systems of ordinary and partial differential equations. Selected readings from the literature covering current models of cardiovascular, renal, neural, respiratory, and sensory systems. (.5 ED/ .5 ES) Prerequisite: Mathematics 111 or equivalent. One course. *Paspoularides*

250. Cardiovascular Mechanics. Mechanical principles and their applications in the human circulatory system. The coupling of solid and fluid behavior in cardiovascular organs is emphasized. Topics include: gravity and the circulation, kinematics of blood flow and circulatory volume balances, peripheral resistance, wall stresses and deformations, cardiac cycle and cardiac work, circulatory wave propagation, unsteady velocity profiles and boundary layers. Special student projects involve the design of diagnostic and therapeutic instruments and devices for cardiovascular applications. (.5 ED/ .5 ES) Prerequisites: Biomedical Engineering 110 and Mathematics 111. One course. *Paspoularides*

255. Safety of Medical Devices. Safety of medical devices such as prosthetic heart valves and silicone breast implants. Engineering analysis of the safety of biomedical instrumentation in the context of the regulations of the U.S. Food and Drug Administration. Engineering performance standards and FDA requirements for clinical trials for selected medical devices such as medical diagnostic ultrasound, surgical lasers, and

prosthetic heart valves. Students will prepare a mock application for FDA premarket approval to demonstrate safety of a selected medical device. (.25 ED/.75 ES) Prerequisite: Biomedical Engineering 164L or consent of instructor. One course. *S. Smith*

264. Medical Instrument Design. General principles of signal acquisition, amplification processing, recording, and display in medical instruments. System design, construction, and evaluation techniques will be emphasized. Methods of real-time signal processing will be reviewed and implemented in the laboratory. Each student will design, construct, and demonstrate a functional medical instrument and collect and analyze data with that instrument. Formal write-ups and presentations of each project will be required. (.75 ED/.25 ES) Prerequisite: Biomedical Engineering 164, senior standing. One course. *Trahey*

265. Advanced Topics in Biomedical Engineering. Advanced subjects related to programs within biomedical engineering tailored to fit the requirements of a small group. Consent of instructor required. (.5 ED/.5 ES) One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

106. Mass and Energy Balances in Chemical and Biological Systems

132. Statistical and Computational Methods in Signal Processing

204. Measurement and Control of Cardiac Electrical Events

206L. Microprocessors and Digital Instruments

243. Introduction to Medical Informatics

THE MAJOR

The major requirements are included in the minimum total of thirty-four courses listed under general requirements and departmental requirements. The following specific courses must be included: Biomedical Engineering 101, 163, 164, and 207.

Civil and Environmental Engineering (CE)

Professor Petroski, *Chair*; Associate Professor Pas, *Director of Undergraduate Studies*; Professors Haff, Melosh, S. Utku, Vesilind, and J. F. Wilson; Associate Professors Biswas, Bryers, Hueckel, Medina, Peirce, and Reckhow; Assistant Professors Faust, Jacobs, Laursen, and Virgin; Professor Emeritus Brown; Research Associate Professor Biswas; Adjunct Associate Professor B. Utku

A major in civil engineering is available in this department.

The infrastructure that makes up what we refer to as civilization is, for the most part, the work of civil and environmental engineers. Improving, or even maintaining, the quality of life is ever more challenging as urban problems in the industrialized nations of the world intensify, while rapid urbanization in many developing countries creates other problems for the civil and environmental engineer. The planning, design, construction, and maintenance of necessary facilities, in an era of increasingly scarce monetary and other resources, demands civil and environmental engineers dedicated to work for the public good and prepared to seek more efficient and effective solutions.

The challenges faced by civil and environmental engineers vary widely in nature, size, and scope, and encompass both the public and private sectors. Examples include: space structures and launch facilities, hazardous waste disposal facilities, water supply and treatment facilities, power plants, bridges, dams, buildings, tunnels, highways, subways, seaports and airports, and offshore structures. The professors of the Department of Civil and Environmental Engineering at Duke strive to educate their students

to assume leadership roles in their chosen careers as well as to recognize their professional and personal obligations to the broader society and culture. The faculty strives to provide a holistic educational experience where the humanities and the physical and social sciences form the foundation for the critical thinking and skills that allows graduates to enjoy the benefits of a liberal education.

Students can emphasize any one of the specialty areas in which the faculty is engaged in teaching and research, including: environmental engineering, structural engineering and mechanics, transportation and systems engineering, water resources, and geotechnical engineering. The department also offers a Program in Architectural Engineering. Students may also enroll in the BSE/MBA degree program and after five years of study obtain an engineering degree and an MBA degree from Duke's Fuqua School of Business. In addition, students may pursue a degree in civil engineering coupled with a double major in another department at Duke. Examples of recently completed double majors reflect the breadth of interests shared by civil and environmental engineering students at Duke: public policy studies, economics, French, mathematics, and music.

The civil and environmental program at Duke is built upon the expertise and experience of a prominent faculty and is supported by commensurate laboratory and instructional facilities. The civil and environmental engineering professors are committed to providing quality classroom instruction, advising, and laboratory experiences in settings that encourage student-faculty as well as student-student interactions. The faculty conducts research of national and international consequence, and undergraduates have ample opportunities to be involved in such research, through undertaking independent study projects and/or by working as research assistants. The research facilities in the department, including laboratory equipment and instrumentation as well as computer resources, are comparable to those found in other major universities.

Graduates of the Department of Civil and Environmental Engineering are able to select from a wide range of career paths. Some recent graduates have pursued advanced study in engineering, business, law, and architecture, while others have accepted positions with major corporations and federal, state, and local government agencies as design engineers and project managers.

116. Transportation Engineering. The role and history of transportation. Introduction to the planning and design of multimodal transportation systems. Principles of traffic engineering and route location and design. Planning studies and economic evaluation. (.5 ED/.5 ES) Prerequisites: junior or senior standing and consent of instructor for nonengineering students. One course. *Pas*

122L. Fluid Mechanics. Physical properties of fluids; fluid-flow concepts and basic equations; continuity, energy, and momentum principles; dimensional analysis and dynamic similitude; viscous effects; applications emphasizing real fluids. Selected laboratory work. (.3 ED/.7 ES) Corequisite: Engineering 123L. One course. *Haff or Medina*

123L. Water Resources Engineering. Descriptive and quantitative hydrology, hydraulics of pressure conduits and measurement of flow, compound pipe systems, analysis of flow in pressure distribution systems, open channel flow, reservoirs and distribution system storage. Groundwater hydrology and well-hydraulics. Probability and statistics in water resources. Selected laboratory and field exercises, computer applications. (.15 ED/.85 ES) Prerequisite: Civil Engineering 122L. One course. *Medina*

124L. Environmental Engineering. Qualitative and quantitative physical, chemical, and bacteriological characterization of water and wastewater. Introduction to water treatment processes and wastewater collection, treatment and disposal systems. Air

pollution control; solid and hazardous waste management. Laboratory included. Field trips to be arranged. (.75 ED / .25 ES) Prerequisite: Civil Engineering 123L. One course. *Peirce or Vesilind*

127L. Environmental Pollution Control. A study of the environmental causes and effects of air, land, and water pollution. Interactions between the environment and stresses to which it is subjected as a consequence of growth and concentration of populations and their increasing demands on natural resources. Solid waste, recycling, noise pollution, and environmental ethics. Not open to engineering majors. (1.0 ES) One course. *Peirce or Vesilind*

131L. Theory of Structures. Application of mechanics to the analysis of plane and space structures; a unified treatment of statically determinate and indeterminate structural systems. (.3 ED / .7 ES) Prerequisites: Engineering 75L and Mathematics 103. One course. *Biswas or S. Utku*

133L. Structural Design I. Nonhomogenous materials. Determination of physical and mechanical properties of construction materials. Theory and design of compression and flexural members. Emphasis on ultimate strength theory for concrete. Timber design using mechanical fasteners. Laboratory exercises include concrete aggregate evaluation, concrete mix design, and structural timber tests. (1.0 ED) Prerequisite: Civil Engineering 131L. One course. *Biswas*

134L. Structural Design II. Design in metals, primarily steel. Properties of materials as criteria for failure. Tension, compression, and flexural members. Bolted and welded connections, including eccentric connections. Built-up members. Design by elastic and plastic methods. Selected problems to include computations and drawings. (1.0 ED) Prerequisite: Civil Engineering 131L. One course. *Biswas*

139L. Introduction to Soil Mechanics. Origin and composition of soils, soil structure. Flow of water through soils; capillary and osmotic phenomena. Soil behavior under stress; compressibility, shear strength. Elements of mechanics of soil masses with application to problems of bearing capacity of foundations, earth pressure on retaining walls, and stability of slopes. Laboratory included. (.5 ED / .5 ES) Prerequisite: Civil Engineering 122L. One course. *Hueckel*

141, 142. Special Topics in Civil Engineering. Study arranged on a special topic in which the instructor has particular interest and competence. Consent of instructor and Director of Undergraduate Studies required. Half course or one course each. Variable credit. *Staff*

161. Architectural Engineering I. Analysis of the building through the study of its subsystems (enclosure, space, structural, environmental-control). Building materials and their principal uses in the enclosure and structural subsystems. System and material selection studies. Computer aided design documentation. (.5 ED / .5 ES) Prerequisites: junior or senior standing and consent of instructor for nonengineering students. One course. *B. Utku*

162. Architectural Engineering II. Design and integration of building subsystems (enclosure, space, structural, environmental-control) in the design of a medium-sized building. (1.0 ED) Prerequisite: Civil Engineering 161 or consent of instructor. One course. *B. Utku*

192. Civil Engineering Design. Student design teams complete a preliminary design of an actual civil engineering project and present the design to a panel of civil engineering faculty and practitioners. A written technical report is required. Topics to be addressed include: the design process; cost estimation; legal, ethical, and social aspects of professional engineering practice; short-term and long-term design service-

ability considerations. Open only to civil engineering students during their final two semesters. (1.0 ED) One course. *Staff*

197, 198. Projects in Civil Engineering. These courses may be taken by junior and senior engineering students who have demonstrated aptitude for independent work. Consent of instructor and Director of Undergraduate Studies required. Half course or one course each. Variable credit. *Staff*

201. Advanced Mechanics of Solids. Tensor fields and index notation. Analysis of states of stress and strain. Conservation laws and field equations. Constitutive equations for elastic, viscoelastic, and elastic-plastic solids. Formulation and solution of simple problems in elasticity, viscoelasticity, and plasticity. (1.0 ES) One course. *Hueckel or Petroski*

203. Plasticity. Inelastic behavior of soils and engineering materials. Yield criteria. Flow rules. Concepts of perfect plasticity and plastic hardening. Methods of rigid-plasticity. Limit analysis. Isotropic and kinematic hardening. Plastic softening. Diffused damage. Thermo-plasticity. Visco-plasticity. (1.0 ES) Prerequisite: Civil Engineering 201 or consent of instructor. One course. *Hueckel*

204. Plates and Shells. Differential equation and extremum formulations of linear equilibrium problems of Kirchhoffian and non-Kirchhoffian plates of isotropic and orthotropic material. Solution methods. Differential equation formulation of thin shell problems in curvilinear coordinates; membrane and bending theories; specialization for shallow shells, shells of revolution, and plates. Extremum formulation of shell problems. Solution methods. (1.0 ES) Prerequisites: Engineering 75L or 135 and Mathematics 111. One course. *Utku*

205. Elasticity. Introduction to linear theory of elasticity. Constitutive equations for anisotropic and isotropic elastic solids. Formulation and solution of torsion, bending, and flexure problems. Plane, axisymmetric, and three-dimensional problems. (1.0 ES) One course. *Petroski*

207. Transport Phenomena in Biological Systems. (.25 ED / .75 ES) See C-L: Biochemical Engineering 207; also C-L: Biomedical Engineering 207 and Mechanical Engineering 207. One course. *Truskey*

209. Kinetics and Reactor Design. (.5 ED / .5 ES) Prerequisite: Mathematics 111 or consent of instructor. See C-L: Biochemical Engineering 209; also C-L: Biomedical Engineering 209. One course. *Staff*

210. Intermediate Dynamics. (.25 ED / .75 ES) See C-L: Mechanical Engineering 210. One course. *Virgin*

215. Engineering Systems Analysis. Fundamental concepts and tools for engineering systems analysis, including optimization techniques and decision analysis. System definition and model formulation, optimization by calculus, linear programming, integer programming, separable integer programming, nonlinear programming, network analysis, dynamic programming, and decision analysis. Application to diverse engineering systems. (.25 ED / .75 ES) One course. *Pas*

217. Transportation Systems Analysis. The transportation systems planning process. Quantitative analysis; mathematical modeling and computer simulation techniques for short-and long-range planning and evaluation of transportation systems. (1.0 ES) Prerequisite: (or corequisite) Civil Engineering 116 or consent of instructor. One course. *Pas*

218. Engineering Management and Project Evaluation. Statistical analysis and economics. Data organization, distributions, estimates of parameters, hypothesis test-

ing, analysis of variance, experimental design. Economic impact assessment, supply and demand forecasting, benefit/cost analysis, economic incentives, public and private finance, input/output analysis. (1.0 ES) One course. *Peirce*

221. Engineering Systems Reliability, Safety, and Risk Assessment. Introduction to the concepts of design reliability and safety. Topics include: concepts of probability in engineering planning and design, decision analysis and assessment of reliability, modeling and analysis of uncertainty, reliability-based design, multiple failure mode analysis, redundant and nonredundant systems, and fault tree analysis. Emphasis on determining the probability of failure for numerous engineering systems including structural systems, infrastructure systems, water treatment systems, environmental systems, and transportation networks. (5 ED/ 5 ES) Prerequisite: Mathematics 111 or consent of instructor. One course. *Jacobs*

225. Dynamic Engineering Hydrology. Dynamics of the occurrence, circulation, and distribution of water; climate, hydrometeorology, geophysical fluid motions. Precipitation, surface runoff and stream flow, infiltration, water losses. Hydrograph analysis, catchment characteristics, hydrologic instrumentation, and computer simulation models. (1.0 ES) Prerequisite: Civil Engineering 122L or consent of instructor. One course. *Medina*

227. Groundwater Hydrology and Contaminant Transport. Review of surface hydrology and its interaction with groundwater. The nature of porous media, hydraulic conductivity, and permeability. General hydrodynamic equations of flow in isotropic and anisotropic media. Water quality standards and contaminant transport processes: advective-dispersive equation for solute transport in saturated porous media. Analytical and numerical methods, selected computer applications. Deterministic versus stochastic models. Applications: leachate from sanitary landfills, industrial lagoons and ponds, subsurface wastewater injection, monitoring of groundwater contamination. Conjunctive surface-subsurface models. (.1 ED/.9 ES) Prerequisite: Civil Engineering 123L or consent of instructor. One course. *Medina*

228L. Sludge Management and Disposal. The analysis and design of sludge production processes in water and wastewater treatment plants. Sludge thickening, dewatering, drying, incineration, and ultimate disposal. Legal and regulatory restrictions and concerns. (5 ED/ 5 ES) Prerequisite: Civil Engineering 124L or consent of instructor. One course. *Vesilind*

233. Prestressed Concrete Design. A critical review of research and recent developments in prestressed concrete design. Prestressed tanks, beams, and columns; partial prestressing and composite design. (1.0 ED) Prerequisite: Civil Engineering 133L. One course. *Biswas*

237. Advanced Soil Mechanics. Characterization of behavior of geomaterials. Stress-strain incremental laws. Nonlinear elasticity, hypo-elasticity, plasticity and viscoplasticity of geomaterials; approximated laws of soil mechanics; fluid-saturated soil behavior; cyclic behavior of soils; liquefaction and cyclic mobility; elements of soil dynamics; thermal effects on soils. (1.0 ES) Prerequisite: Civil Engineering 139L or equivalent. One course. *Hueckel*

240. Fate of Organic Chemicals in the Environment. Kinetic, equilibrium, and analytical approaches applied to quantitative description of processes affecting the fate of anthropogenic and natural organic compounds in ground, surface, and atmospheric waters and in selected treatment processes, including sorption phenomena, gas transfer, hydrolysis, photochemistry, oxidation-reduction, and biodegradation. Sampling, detection, identification, and quantification of organic compounds in the environment. Gas and liquid chromatology and mass spectrometry. (1.0 ES) Prerequisite: (or corequisite)

Civil Engineering 242/Environment 242 or equivalent. C-L: Environment 240. One course. *Dubay and Faust*

242. Environmental Chemistry. Principles of chemical kinetics and equilibria applied to quantitative description of the chemistry of lakes, rivers, oceans, atmospheric waters, groundwaters, and selected treatment processes. Equilibrium, steady state, and other kinetic models applied to processes such as the carbonate system, coordination chemistry, precipitation and dissolution, oxidation-reduction, photochemistry, heterogeneous reactions, gas transfer, and some aspects of atmospheric chemistry. (1.0 ES) C-L: Environment 242. One course. *Faust*

243. Physicochemical Unit Operations in Water Treatment. Fundamental bases for design of water and waste treatment systems, including transport, mixing, sedimentation and filtration, gas transfer, coagulation, and absorption processes. Emphasis on physical and chemical treatment combinations for drinking water supply. (.25 ED / .75 ES) Prerequisite: Engineering 24L or Civil Engineering 124L. One course. *Vesilind*

244. Applied Microbial Processes. Consent of instructor required. (.25 ED / .75 ES) See C-L: Biochemical Engineering 244. One course. *Staff*

245. Pollutant Transport Systems. Distribution of pollutants in natural waters and the atmosphere; diffusive and advective transport phenomena within the natural environment and through artificial conduits and storage/treatment systems. Analytical and numerical prediction methods. (.1 ED / .9 ES) Prerequisites: Civil Engineering 122L and Mathematics 111 or equivalents. One course. *Medina*

246. Water Supply Engineering Design. The study of water resources and municipal water requirements including reservoirs, transmission, treatment and distribution systems; methods of collection, treatment, and disposal of municipal and industrial wastewaters. The course includes the preparation of a comprehensive engineering report encompassing all aspects of municipal water and wastewater systems. Field trips to be arranged. (1.0 ED) Prerequisite: Engineering 24L or Civil Engineering 124L or consent of instructor. One course. *Vesilind*

248. Solid Waste and Resource Recovery Engineering. Engineering design of resource recovery systems including traditional and advanced technologies. Sanitary landfills and incineration of solid wastes. Energy recovery and recycling processes. Application of systems analysis to collection of municipal refuse. Collection, treatment, and disposal of solid wastes from wastewater treatment. (1.0 ED) Prerequisite: Engineering 24L or Civil Engineering 124L. One course. *Vesilind*

249. Control of Hazardous and Toxic Waste. Engineering solutions to industrial and municipal hazardous waste management problems. Handling, transportation, storage, and disposal technologies. Biological, chemical, and physical processes. Upgrading an abandoned disposal site. Economic and regulatory aspects. Case studies. Consent of instructor required. (.50 ED / .50 ES) One course. *Perce*

251. Systematic Engineering Analysis. Mathematical formulation and numerical analysis of discrete engineering systems with emphasis on theory of structures. Equilibrium and eigenvalue problems in continuum; properties of these systems and their discretization by the trial functions with undetermined parameters. The use of weighted residual methods, finite elements, and finite differences. (.3 ED / .7 ES) Prerequisite: senior or graduate standing. One course. *S. Utku*

252. Buckling of Engineering Structures. An introduction to the underlying concepts of elastic stability and buckling, development of classical (differential equation) and modern (energy) approaches, buckling of common engineering components including link models, struts, frames, plates, and shells. Consideration will also be given to

inelastic behavior, postbuckling, and design implications. (.25 ED/.75 ES) Prerequisite: Civil Engineering 131L or consent of instructor. C-L: Mechanical Engineering 252. One course. *Biswas or Virgin*

254. Applications of Finite Element Analysis. Theory of element and material models; models of metals, rock, reinforced concrete, wood, glass, soil, water, and air; analyses of torsion members, shear walls, membranes, plates, shells, solids, and compound structural systems; analysis of soil-structure and fluid-structure systems; prediction of field heating, seepage, and pollution. (.1 ED/.9 ES) Prerequisite: Civil Engineering 251 or consent of instructor. One course. *Staff*

257. Structural Optimization. Computer-aided improvement of structural designs; redesign search processes, sensitivity analysis, integrity analysis; optimization of static, steady-state, and transient response systems; minimization of structural weight and response potentials for trusses, frames, and continua. (.65 ED/.35 ES) One course. *Staff*

265. Advanced Topics in Civil and Environmental Engineering. Opportunity for study of advanced subjects relating to programs within the civil and environmental engineering department tailored to fit the requirements of individuals or small groups. One course. *Staff*

281. Experimental Systems. Formulation of experiments; Pi theorem and principles of similitude; data acquisition systems; static and dynamic measurement of displacement, force, and strain; interfacing experiments with digital computers for data storage, analysis, and plotting. Students select, design, perform, and interpret laboratory-scale experiments involving structures and basic material behavior. (.3 ED/.7 ES) Prerequisite: senior or graduate standing in engineering or the physical sciences. One course. *J. F. Wilson*

283. Structural Dynamics. Formulation of dynamic models for discrete and continuous structures, normal mode analysis, deterministic and stochastic responses to shocks and environmental loading (earthquakes, winds, and waves), introduction to nonlinear dynamic systems, analysis and stability of structural components (beams and cables and large systems such as offshore towers, moored ships, and floating platforms). (1.0 ES) One course. *J. F. Wilson*

COURSES CURRENTLY UNSCHEDULED

202. Advanced Mechanics of Solids II

212. Mechanical Behavior and Fracture of Materials

216. Transportation Planning and Policy Analysis

226. Operational Hydrology

232. Reinforced Concrete Design

234. Advanced Structural Design in Metals

235. Foundation Engineering

236. Earth Structures

238. Rock Mechanics

239. Physical Properties of Soils

247. Air Pollution Control

258. Analysis of Dynamic and Nonlinear Behavior of Structures

THE MAJOR

The major requirements are included in the minimum of thirty-four courses listed under general requirements and departmental requirements. The following specific courses must be included: Engineering 24L, 25L, 75L, 115, 123L, and 150L; Civil Engineering 122L, 131L, and 192.

Electrical Engineering (EE)

Professor Casey, *Chair*; Visiting Professor McCumber, *Director of Undergraduate Studies*; Professors Fair, Joines, Marinos, Nolte, Pilkington, Trivedi, Wang, and Wilson; Associate Professors Dugan, Kedem, Krolik, and Massoud; Assistant Professors Alexandrou, Board, Daniels-Race, Dollas, George, Hansen, and Overhauser; Professor Emeritus Owen; Research Assistant Professor Bottomley; Adjunct Professors Glomb, Lontz, and Stroschio; Adjunct Associate Professors Derby and Kanapoulos; Adjunct Assistant Professors Goodwin-Johansson, Loeb, and Strole; Visiting Professor Iafrate

A major is available in this department.

Electrical engineering is a broadly-based discipline dealing with the processing, control, and transmission of information and energy by making use of electrical and electromagnetic phenomena. Electrical engineers design, build, and make extensive use of computers. The twenty-first century will have continuing demands for electronic systems in most industrial and consumer products.

Graduates with electrical engineering backgrounds are prepared for their first job in engineering or management as well as to undertake graduate or professional school education in a variety of disciplines. The curriculum permits students to concentrate in such areas as computer engineering, signal processing and communications, solid-state electronics and circuits, electromagnetic fields and optics, and electronic systems. The flexibility of the undergraduate curriculum permits students to complete the requirements for a second major in such areas as biomedical engineering, computer science, physics, mathematics, history, public policy studies, and many others. Students with interests such as premedicine, prelaw, economics, art, music, psychology, and social sciences can be accommodated within the curriculum through individually designed programs. The classroom lectures are enhanced by extensive use of the department's computer and laboratory facilities. The department maintains over forty networked computer workstations, servers, and "X-window" displays interconnected via an Ethernet network which also gives access to campus, regional, and international data networks, including Internet and BITNET. The instructional computers include an IBM RS-6000 series machine, HP-Apollo CAD stations, and HP 9000 series workstations. X-terminals allow access to various computer clusters in the Engineering Building as well as some three dozen departmental Sun, DEC, and IBM workstations.

Numerous undergraduate laboratories are well-equipped with electronic components, digitizing oscilloscopes, and PC controlled instrumentation, as well as equipment such as logic analyzers used in computer logic design. Laboratories and equipment are also available for microprocessor and computer architecture studies, rapid system prototyping, custom integrated circuit design and testing, integrated circuit fabrication, digital speech processing, image processing, robotics, digital communications, micro-waves, and power electronics. These laboratories are important to the undergraduate program since they permit students to become actively acquainted with the devices and design tools of electrical engineering through regularly scheduled experiments, independent projects, and occasionally, part-time assistance to faculty members engaged in research. Opportunities for independent study are related to the current areas of research which are: computer engineering, computer architecture, fault-tolerant computer systems, scientific computing, parallel processing, VLSI CAD tools, signal processing, digital speech processing, signal detection and estimation, ocean acoustic signal processing, image processing, solid-state electronics, integrated circuit processing and

process simulation, molecular-beam epitaxy, III-V compound semiconductor materials and devices, machine intelligence, applications of electromagnetic fields and waves, power electronics and magnetics.

61L. Introduction to Electric Circuits. Techniques for analyzing linear circuits. Discussion of common source waveforms, dependent sources, amplifiers, and Op-Amps. Treatment of circuits operating in the AC steady state. Introduction to transfer functions, frequency response, and filters. (.25 ED / .75 ES) Prerequisite: Mathematics 32. One course. *Staff*

62L. Introduction to Electronic Circuits. Emphasis on circuits containing discrete electronic devices. Models for diodes and transistors including BJTs and FETs. Treatment of nonlinear diode and digital logic circuits. Analysis and design of transistor circuits and electronic amplifiers, including the use of computer-aided software; for example, SPICE. (.50 ED / .50 ES) Prerequisite: Electrical Engineering 61. One course. *Staff*

63L. Introduction to Electrical Systems. Discussion of signal processing and communication systems. Introduction to feedback and its application to control systems. Treatment of energy conversion and electromechanics. (.25 ED / .75 ES) Prerequisite: Electrical Engineering 62. One course. *Staff*

64. Fundamentals of Linear System Theory. Signal representations, system response, convolution, correlation; Fourier series and transforms, transfer functions; Laplace transforms, state variables, stability; discrete signals and transforms, fast Fourier transform; z transforms. Applications to networks, modulation, sampling, filtering. Computer solutions of problems using MAPLE and SPICE. (1.0 ES) Prerequisite: Electrical Engineering 61L. One course. *Staff*

141. Linear Control Systems. Analysis and design of feedback control systems. Block diagram and signal flow graph system models. Servomechanism characteristics, steady-state errors, sensitivity to parameter variations and disturbance signals. Time domain performance specifications. Stability. Root locus, Nyquist, and Bode analysis; design of compensation circuits; closed loop frequency response determination. Introduction to time domain analysis and design. (.50 ED / .50 ES) Prerequisite: Electrical Engineering 64 or consent of instructor. One course. *Wang*

142. Introduction to Robotics and Automation. Fundamental notions in robotics, basic configurations of manipulator arm design, coordinate transformations, control functions, and robot programming. Applications of artificial intelligence, machine vision, force/torque, touch and other sensory subsystems. Design for automatic assembly concepts, tools, and techniques. Application of automated and robotic assembly costs, benefits, and economic justification. Selected laboratory and programming assignments. (.25 ED / .75 ES) Prerequisites: Electrical Engineering 64 and consent of instructor. One course. *Staff*

151. Introduction to Switching Theory and Logic Design. Techniques for the analysis and design of combinational and sequential networks. Discrete mathematical systems, binary arithmetic, Boolean algebra, minimization of functions, synchronous and fundamental mode sequential circuit design, design with MSI and LSI components, and special properties of switching functions are covered. Selected laboratory work. (.25 ED / .75 ES) C-L: Computer Science 157. One course. *Marinos or Overhauser*

152. Introduction to Computer Architecture. Architecture and organization of digital computer systems. Processor operation, computer arithmetic, instruction set design. Assembly language programming. Selected hardware and software exercises culminating in design and construction of a complete computer system. Not open to students who have taken Computer Science 104. (.75 ED / .25 ES) Prerequisite: Electrical Engineering 151. One course. *Board or Dallas*

156. Computer Network Architecture. The architecture of computer communication networks and the hardware and software required to implement the protocols that define the architecture. Basic communication theory, transmission technology, private and common carrier facilities. International standards. Satellite communications and local area networks. Performance analysis and modeling of communication networks. (.25 ED / .75 ES) Prerequisite: Electrical Engineering 151. One course. *Strole*

161L. Integrated Electronics I. Graphical and mathematical modeling of electronic devices such as diodes, and bipolar-junction and field-effect transistors; techniques for the analysis and design of electronic circuits with emphasis on large-signal and small-signal methods; applications of these methods to particular circuits, including regulators, bias-point stability, amplifiers, and switching circuits; computer simulation of electronic circuits using SPICE. Three class sessions and one computation or laboratory session. (.75 ED / .25 ES) Prerequisite: Electrical Engineering 62. One course. *George*

162. Integrated Electronics II. Feedback and operational amplifiers: a study of feedback analysis, stability design, circuits; bipolar junction transistor and MOS operational amplifier analyses, stability techniques, noise, and other topics. Laboratory and computer simulation work using SPICE. (.75 ED / .25 ES) Prerequisite: Electrical Engineering 161. One course. *Derby or George*

170. Introduction to Electromagnetic Fields. Postulatory treatment of electromagnetic fields based on Maxwell's equations. Discussion of the Lorentz force equation and the Poynting theorem. Treatment of propagation, reflection, and transmission of plane waves through various media and dielectric interfaces. Introduction to electrostatic and magnetostatic fields and potential functions. (.25 ED / .75 ES) Prerequisites: Mathematics 104 or 111 and Physics 52L. One course. *Joines or Wilson*

171. Applications of Electromagnetic Fields and Waves. Solution techniques applied to static and dynamic field problems. Discussions and example applications include the following topics: waves and transmission lines, waveguides and resonators, antennas and radiation, and electromagnetic forces and energy. (.50 ED / .50 ES) Prerequisite: Electrical Engineering 170. One course. *Joines*

176. Thermal Physics. Thermal properties of matter treated using the basic concepts of entropy, temperature, chemical potential, partition function and free energy. Topics include the laws of thermodynamics, ideal gases, thermal radiation and electrical noise, heat engines, Fermi-Dirac and Bose-Einstein distributions, semiconductor statistics, kinetic theory, and phase transformations. (1.0 ES) Prerequisites: Physics 51L, 52L or equivalent and Mathematics 103 or equivalent. C-L: Physics 176. One course. *McCumber or Teitsworth*

181. Fundamentals of Signal Processing and Communications. The fundamentals of signal representation and system characterization used in digital signal processing and communications. Communication systems: basic concepts in amplitude modulation, frequency division multiplexing, amplitude shift keying, pulse code modulation, matched filtering. Discrete-time signal processing: discrete-time systems, response with noisy excitation, introduction to digital filter design, discrete Fourier transform, fast Fourier transform. Computer applications in selected areas using MATLAB. (.25 ED / .75 ES) Prerequisites: Electrical Engineering 64 and Mathematics 135 or Statistics 113, or consent of instructor. One course. *Alexandrou, Hansen, or Nolte*

182. Digital Filter Design. A treatment of the theory and application of processing of discrete time data. Special attention will be given to the design and implementation of both finite impulse response (FIR) and infinite impulse response (IIR) digital filters. Bilinear transformations, filter design based on Butterworth, Chebyshev, and elliptic approximations, transversal filters, effects of quantization and finite word length arith-

metic in digital filters. Applications of Digital Signal Processing in such areas as image, sonar/radar, and speech communications. (.75 ED/ .25 ES) Prerequisite: Electrical Engineering 181. One course. *Alexandrou, Hansen, or Nolte*

187. Digital Telecommunications. Examination of existing telephone networks in the U.S. with emphasis on the transition from analog to digital systems. Sequential processes of encoding, transmission, switching, and network hierarchy. Consideration of the problems which must be solved in the transition from analog to digital networks. (.50 ED/ .50 ES) Prerequisite: Electrical Engineering 181. One course. *Glomb*

189. Image Processing. Basic concepts of the manipulation and analysis of images by computer, linear operations on pictures, Fourier transform and 2-D Z-transform, hexagonal sampling theorem, image transforms, image enhancement, image filtering and restoration, image coding, matching, segmentation, representation and description. Project presentation by students. (.50 ED/ .50 ES) Prerequisites: Electrical Engineering 181 and Mathematics 135. One course. *Staff*

191, 192. Undergraduate Research in Electrical Engineering. For juniors only. (Var. ED/ES) Half course or one course each. Variable credit. *Staff*

193, 194. Undergraduate Research in Electrical Engineering. For seniors only. (Var. ED/ES) Half course or one course each. Variable credit. *Staff*

195, 196. Special Topics in Electrical Engineering. Study of selected topics in electrical engineering tailored to fit the requirements of a small group. Consent of instructor and Director of Undergraduate Studies required. (Var. ED/ES) Half course or one course each. Variable credit. *Staff*

197, 198. Projects in Electrical Engineering. A course which may be undertaken only by seniors who are enrolled in the graduation with distinction program or who show special aptitude for individual project work. Elective for electrical engineering majors. Consent of Director of Undergraduate Studies required. (Var. ED/ES) Half course to two courses each. Variable credit. *Staff*

211. Quantum Mechanics. Discussion of wave mechanics including elementary applications, free particle dynamics, Schrödinger equation including treatment of systems with exact solutions, and approximate methods for time-dependent quantum mechanical systems with emphasis on quantum phenomena underlying solid-state electronics and physics. (1.0 ES) Prerequisite: Mathematics 111 or equivalent. One course. *Staff*

214. Introduction to Solid-State Physics. Discussion of solid-state phenomena including crystalline structures, x-ray and particle diffraction in crystals, lattice dynamics, free electron theory of metals, energy bands, and superconductivity, with emphasis on understanding electrical and optical properties of solids. (.25 ED/ .75 ES) Prerequisite: quantum physics at the level of Physics 143L or Electrical Engineering 211. C-L: Physics 214. One course. *Teitsworth*

216. Devices for Integrated Circuits. Derivation of basic semiconductor properties such as the effective mass, effective density of states, SHR recombination, avalanche breakdown and energy-band diagrams. Application of the continuity equation, Gauss' law, and Poisson's equation to obtain the I-V and C-V behavior of Si and GaAs Schottky barriers, GaAs MESFETs; Si JFETs, bipolar transistors and MOSFETs. Relation of device physics to SPICE parameters. Four laboratory exercises. (.25 ED/ .75 ES) One course. *Casey*

217. Analog Integrated Circuits. Analysis and design of analog integrated circuits. Bipolar and MOSFET circuits. SPICE models. Elementary integrated amplifier circuits, performance of operational amplifiers and other analog circuits including frequency

response and noise. A/D converters and switched capacitor filters. (.50 ED / .50 ES)
Prerequisite: Electrical Engineering 216. One course. *Staff*

218. Integrated Circuit Engineering. Basic processing techniques and layout technology for integrated circuits. Photolithography, diffusion, oxidation, ion implantation, and metallization. Design, fabrication, and testing of integrated circuits. (.50 ED / .50 ES)
Prerequisite: Electrical Engineering 216. One course. *Fair*

219. Digital Integrated Circuits. Analysis and design of digital integrated circuits. MOSFET and bipolar devices. SPICE models. Major logic families such as NMOS, CMOS, TTL, ECL, and I²L as well as regenerative logic circuits and memories. Circuit design considerations for VLSI. (.50 ED / .50 ES) Prerequisites: Electrical Engineering 151 and 216. One course. *Massoud*

243. Pattern Classification and Recognition. Parameter estimation and supervised learning, nonparametric techniques, linear discriminant functions, clustering, language theory related to pattern recognition, examples from areas such as character and severe weather recognition, classification of community health data, recognition of geometrical configurations, algorithms for recognizing low resolution touch-sensor array signatures and 3-D objects. Consent of instructor required. (.50 ED / .50 ES) One course. *Wang*

245. Digital Control Systems. Review of traditional techniques used for the design of discrete-time control systems; introduction of "nonclassical" control problems of intelligent machines such as robots. Limitations of the assumptions required by traditional design and analysis tools used in automatic control. Consent of instructor required. (.25 ED / .75 ES) One course. *Myers*

251. Advanced Digital System Design. Theory and hands-on experience in advanced digital system design. High-speed design, high complexity design (more than 10,000 gates), implementation technology selection, system modeling, power and clock distribution, line termination, and cooling. Case studies and demonstrations. Extensive use of CAD tools for logic minimization, logic synthesis, and system simulation. Rapid system prototyping with off-the-shelf and custom components. Laboratory exercises and a semester project. (.75 ED / .25 ES) Prerequisites: Electrical Engineering 151 and 161. One course. *Dollas*

252. Advanced Digital Computer Architecture. A second course on computer architecture. Definition of high-performance computing. The von Neumann bottleneck, Amdahl's law. Computer taxonomies. Memory organization, Princeton/Harvard architectures, caches, and virtual memory. Instruction pipelining. Vector processing. Instruction sets (RISC/CISC/VLIW). Parallel processing (SIMD/MIMD). Multiprocessor interconnection networks, communications, and synchronization. (.50 ED / .50 ES) Prerequisite: Computer Science 104 or Electrical Engineering 152. One course. *Board or Dollas*

254. Fault-Tolerant and Testable Computer Systems. Faults and failure mechanisms, test generation techniques and diagnostic program development for detection and location of faults in digital networks; design for testability, redundancy techniques, self-checking and fail-safe networks, fault-tolerant computer architectures. (.50 ED / .50 ES) Prerequisite: Electrical Engineering 151 or equivalent. C-L: Computer Science 207. One course. *Marinos*

255. Mathematical Methods for Systems Analysis I. Basic concepts and techniques used in the stochastic modeling of systems. Elements of probability, statistics, queuing theory, and simulation. (.25 ED / .75 ES) Prerequisite: four semesters of college mathematics. C-L: Computer Science 226. One course. *Trivedi*

257. Performance and Reliability of Computer Networks. Methods for performance and reliability analysis of local area networks as well as wide area networks. Probabilistic analysis using Markov models, stochastic Petri nets, queuing networks, and hierarchical models. Statistical analysis of measured data and optimization of network structures. (.25 ED/ .75 ES) Prerequisites: Electrical Engineering 156 and 255. One course. *Trivedi*

261. Introduction to VLSI Design. A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. (.75 ED/ .25 ES) Prerequisite: Electrical Engineering 151 or equivalent; Electrical Engineering 161 or equivalent. One course. *Dallas or Overhauser*

262. Advanced VLSI Design and Test. An advanced course in VLSI design with emphasis on the design of application specific IC's (ASIC) for a given set of specifications. Discussions of available technologies for ASIC implementation and tradeoffs in using these technologies. Static and dynamic CMOS design of commonly used circuits (adders, multipliers, RAM, pads). Packaging and testing of ASIC's with emphasis on functional and performance verification. This course stresses the design of ASIC's within a systems design environment and with the use of appropriate design tools that can be used to validate a design based on a given set of design specifications. (.75 ED/ .25 ES) Prerequisite: Electrical Engineering 261 or Computer Science 210. One course. *Dallas or Kanopoulos*

266. Introduction to VLSI Design Verification Techniques. VLSI verification tool design. Design and capabilities of circuit simulation, timing simulation, logic simulation, and functional simulation. Techniques applied in timing verification and other static verification tools. Parallel processing and its application to simulation. Physical design issues related to verification. (.75 ED/ .25 ES) Prerequisite: Electrical Engineering 261, working knowledge of C. One course. *Overhauser*

269. Introduction to VLSI Chip Testing. Introduction to VLSI chip and system testing. Testing theory, strategies, and fault identification. Hands-on testing experience with faulty chips and systems, chips designed in Electrical Engineering 261, and testing equipment available in the department. (.5 ED/ .5 ES) Prerequisite: Electrical Engineering 261. One course. *Overhauser*

271. Electromagnetic Theory. The classical theory of Maxwell's equations; electrostatics, magnetostatics, boundary value problems including numerical solutions, currents and their interactions, and force and energy relations. Three class sessions. Consent of instructor required. (.50 ED/ .50 ES) One course. *Joines*

272. Electromagnetic Communication Systems. Review of fundamental laws of Maxwell, Gauss, Ampere, and Faraday. Elements of waveguide propagation and antenna radiation. Analysis of antenna arrays by images. Determination of gain, loss, and noise temperature parameters for terrestrial and satellite electromagnetic communication systems. (.5 ED/ .5 ES) Prerequisite: Electrical Engineering 170 or 271. One course. *Joines*

273. Optical Communication Systems. Mathematical methods, physical ideas, and device concepts of optoelectronics. Maxwell's equations, and definitions of energy density and power flow. Transmission and reflection of plane waves at interfaces. Optical resonators, waveguides, fibers, and detectors are also presented. (.50 ED/ .50 ES) Prerequisite: Electrical Engineering 170 or equivalent. One course. *Joines*

274. Modern Optics. Optical processes including the propagation of light, coherence, interference, and diffraction. Consideration of the optical properties of solids with applications of these concepts to lasers and modern optical devices. (.25 ED / .75 ES) C-L: Physics 185. One course. *Guenther*

275. Microwave Electronic Circuits. Microwave circuit analysis and design techniques. Properties of planar transmission lines for integrated circuits. Matrix and computer-aided methods for analysis and design of circuit components. Analysis and design of input, output, and interstage networks for microwave transistor amplifiers and oscillators. Topics on stability, noise, and signal distortion. (.75 ED / .25 ES) Prerequisites: Electrical Engineering 161 and 170 or equivalent. One course. *Joines*

281. Random Signals and Noise. Introduction to mathematical methods of describing and analyzing random signals and noise. Review of basic probability theory; joint, conditional, and marginal distributions; random processes. Time and ensemble averages, correlation, and power spectra. Optimum linear smoothing and predicting filters. Introduction to optimum signal detection and parameter estimation. (1.0 ES) Prerequisite: Mathematics 135 or Statistics 113. One course. *Hansen*

282. Digital Signal Processing. Introduction to the fundamentals of processing signals by digital techniques with applications to practical problems. Discrete time signals and systems, elements of the Z-transform, discrete Fourier transforms, digital filter design techniques, fast Fourier transforms, and discrete random signals. (.50 ED / .50 ES) One course. *Nolte*

283. Digital Communication Systems. Digital modulation techniques. Coding theory. Transmission over bandwidth constrained channels. Signal fading and multipath effects. Spread spectrum. Optical transmission techniques. (.50 ED / .50 ES) Prerequisite: Electrical Engineering 281 or consent of instructor. One course. *Bottomley*

285. Signal Detection and Extraction Theory. Introduction to signal detection and information extraction theory from a statistical decision theory viewpoint. Subject areas covered within the context of a digital environment are decision theory, detection and estimation of known and random signals in noise, estimation of parameters and adaptive recursive digital filtering, and decision processes with finite memory. Applications to problems in communication theory. (.50 ED / .50 ES) Prerequisite: Electrical Engineering 281 or consent of instructor. One course. *Nolte*

286. Digital Processing of Speech Signals. Detailed treatment of the theory and application of digital speech processing. Modeling of the speech production system and speech signals; speech processing methods; digital techniques applied in speech transmission, speech synthesis, speech recognition, and speaker verification. Acoustic-phonetics, digital speech modeling techniques, LPC analysis methods, speech coding techniques. Application case studies: synthesis, vocoders, DTW (dynamic time warping)/HMM (hidden Markov modeling) recognition methods, speaker verification/identification. (.25 ED / .75 ES) Prerequisite: Electrical Engineering 182 or equivalent or consent of instructor. One course. *Hansen*

287. Underwater Communications. Elements of communication theory and digital signal processing are combined with basic physics and oceanography to offer an overview of underwater communications, with an emphasis on the radar/sonar problem. Beamforming with transducer arrays. Signal design and target resolution; the ambiguity function. The ocean as a communication channel: sound propagation and ambient noise characteristics. Performance analysis of selected communication scenarios and case studies of operational sonar systems. (.50 ED / .50 ES) Prerequisite: Electrical Engineering 181 or consent of instructor. One course. *Alexandrou*

288. Image and Array Signal Processing. Multidimensional digital signal processing with applications to practical problems in image and sensor array processing. Two-dimensional discrete signals and systems, discrete random fields, 2-D sampling theory, 2-D transforms, image enhancement, image filtering and restoration, space-time signals, beamforming, and inverse problems. (.5 ED/.5 ES) Prerequisite: Electrical Engineering 282 or consent of instructor. One course. *Krolik*

299. Advanced Topics in Electrical Engineering. Opportunity for study of advanced subjects related to programs within the electrical engineering department tailored to fit the requirements of a small group. Consent of Director of Undergraduate Studies and of supervising instructor required. One course. *Staff*

COURSES CURRENTLY UNSCHEDULED

131. Introduction to Nonlinear Theory and Power Electronics

215. Semiconductor Physics

241. Linear Systems

THE MAJOR

The major requirements are included in the minimum total of 34 courses listed under the general requirements and departmental requirements. The electrical engineering department requires the equivalent of 4.25 engineering design and 8.50 engineering science courses. This engineering design requirement must include a course which is more than 0.5 ED and must be taken in the junior or senior year of the program. This course must have as a prerequisite at least one course in the discipline.

Mechanical Engineering and Materials Science (ME)

Professor Hochmuth, *Chair*; Assistant Professor Buzzard, *Director of Undergraduate Studies*; Professors Bejan, Cocks, Dowell, Garg, Gösele, Harman, Pearsall, Shaughnessy, Shepard, and Tan; Associate Professors Bliss, Jones, Knight, Needham, Quinlan, and Wright; Assistant Professors Cherry, Clark, Hall, Thompson, and Virgin; Research Associate Professor Tran-Son-Tay; Research Assistant Professors Nagchaudhuri, Peretti and Ting-Beall; Adjunct Professor Lee; Adjunct Associate Professors Crowson, Jenkins, and Wu; Adjunct Assistant Professor Spano

A mechanical engineering major is available in this department.

Traditionally it was the mechanical engineer who designed the machinery that powered the factories and that manufactured and transported the goods that made possible the Industrial Revolution. The engines, turbines, rolling mills, forges, presses, machine tools, and manufacturing machinery required by this revolutionary period of mankind gave birth to the mechanical engineering profession. The modern mechanical engineer enjoys a very broad involvement within industry and may be found within almost all areas of our present technological society. Design of power plants and machinery remains at the heart of mechanical engineering but will today embody such modern concepts as robotics and computer or microprocessor controlled automation. The involvement of the mechanical engineer may run the entire spectrum from highly sophisticated analysis to the day-to-day problems of maintaining a manufacturing facility.

Technical sales is an area that many mechanical engineers find appealing and where they find themselves in great demand. Many mechanical engineers will use their technical background as a basis for further professional studies leading to such areas as patent law and industrial management. The search for solutions to society's problems requires the engineer to interact with other professions and disciplines, to reach out for an understanding of the economic, social, and political consequences of engineering

decisions. Elective opportunities in the social sciences, life sciences, and humanities help to fill this need.

The department has well equipped undergraduate and research laboratories along with a distinguished faculty committed to excellence in undergraduate instruction. Areas of faculty expertise include thermodynamics, heat transfer, fluid mechanics, aerodynamics, acoustics, computational fluid mechanics and heat transfer, control, robotics, expert systems, failure analysis, safe product design, biological fluid mechanics, biorheology, physical metallurgy, mechanical metallurgy, polymers, corrosion, electronic materials, and high temperature semiconductors. Independent study and the graduation with distinction programs allow qualified undergraduates to participate in the research programs of the department. In addition to a major in mechanical engineering, the department offers the opportunity for extensive study in the area of materials science.

11, 12. Undergraduate Research in Mechanical Engineering. An elective program in which undergraduate students participate in an ongoing program of research with mechanical engineering faculty members. The research topic pursued by the student is arranged by mutual agreement between the student and the participating faculty member. For freshmen only. Quarter course each. *Staff*

101L. Thermodynamics. The principal laws of thermodynamics for open and closed systems and their application in engineering. Properties of the pure substance, relationships among properties, mixtures and reactions. Power and refrigeration cycle analysis. (1.0 ES) Prerequisite: Physics 52L. One course. *Cherry, Harman, or Hochmuth*

102. Thermodynamics II. Application of the laws of thermodynamics to gas and vapor cycles. Compressor, turbine, and internal combustion engine design and performance. Refrigeration systems and analysis and applications in air conditioning. Aircraft propulsion system performance. Thermodynamics of direct energy conversion devices. (.5 ED / .5 ES) Prerequisite: Mechanical Engineering 101L. One course. *Harman*

115L. Failure Analysis and Prevention. A study and analysis of the causes of failure in engineering materials and the diagnosis of those causes. Elimination of failures through proper material selection, treatment, and use. Case histories. Examination of fracture surfaces. Laboratory investigations of different failure mechanisms. (.5 ED / .5 ES) Prerequisites: Engineering 75L and 83L or consent of instructor. One course. *Cocks, Jones, or Pearsall*

120L. Engineering Instrumentation and Measurements. Analysis, design, and application of instrumentation. Error analysis and propagation. Experimental laboratory with PC based measurement and data acquisition, analysis, and graphic display. (.25 ED / .75 ES) Corequisite: Mechanical Engineering 130L. One course. *Buzzard*

126L. Fluid Mechanics. An introductory course emphasizing the application of the principles of conservation of mass, momentum, and energy to a fluid system. Physical properties of fluids, dimensional analysis and similitude, viscous effects and integral boundary layer theory, subsonic and supersonic flows, normal shock waves. Selected laboratory work. (.25 ED / .75 ES) Corequisites: Engineering 123L and Mechanical Engineering 101L. One course. *Hall, Hochmuth, or Knight*

130L. Modeling and Analysis of Dynamic Systems. Mathematical modeling of mechanical, electrical, fluid, and thermal systems. Emphasis is placed on a universal approach to system analysis. Topics include: state variables, linearization methods, transfer functions and block diagrams, and feedback techniques for the control of dynamic systems. (.25 ED / .75 ES) Prerequisites: Mathematics 103 and Physics 51L. One course. *Garg, Nagchaudhuri, Virgin, or Wright*

141L. Mechanical Design. A study of practical aspects of mechanical design including conceptualization, specifications, and selection of mechanical elements. The design and application of mechanical components such as gears, cams, bearings, springs, and shafts. Practice in application of the design process through design projects. (1.0 ED) Prerequisite: Mechanical Engineering 115L. One course. *Wright*

150L. Heat and Mass Transfer. A rigorous development of the laws of mass and energy transport as applied to a continuum. Energy transfer by conduction, convection, and radiation. Free and forced convection across boundary layers. Application to heat exchangers. Selected laboratory work. (.25 ED/.75 ES) Prerequisites: Mathematics 111 and Mechanical Engineering 126L. One course. *Cherry*

153. Heating, Air Conditioning, and Refrigeration. Principles of thermodynamics, heat transfer, and fluid flow applied to comfort and industrial air conditioning. Cycles and equipment for heating, cooling, and humidity control. Air transmission and distribution. Modern vapor compression, absorption, and low temperature refrigeration cycles and systems. (.8 ED/.2 ES) Prerequisite: Mechanical Engineering 101L. One course. *Staff*

160L. Mechanical Systems Design. An integrative design course addressing both creative and practical aspects of the design of systems. Development of the creative design process, including problem formulation and needs analysis, feasibility, legal, economic and human factors, aesthetics, safety, synthesis of alternatives, and design optimization. Application of design methods through several projects including a term design project. (1.0 ED) Prerequisites: Mechanical Engineering 141L and 150L. One course. *Staff*

165. Special Topics in Mechanical Engineering. Study arranged on a special engineering topic in which the faculty has particular interest and competence as a result of research and professional activities. Consent of instructor and Director of Undergraduate Studies required. Half course or one course each. Variable credit. *Staff*

183. Power Generation. Basic concepts of thermodynamics, heat transfer, and fluid flow applied to power generation processes. Nuclear reaction theory and reactor technology; fossil fuel combustion theory and modern boiler practice. Power plant ancillary equipment and processes. Design considerations and analyses include economic and environmental factors. (.5 ED/.5 ES) One course. *Harman*

198. Projects in Mechanical Engineering. Individual projects arranged in consultation with a faculty member. Open only to seniors enrolled in the graduation with distinction program or showing special aptitude for research. Half course to two courses. Prerequisites: B average and consent of the Director of Undergraduate Studies. Variable credit. *Staff*

202. Engineering Thermodynamics. Axiomatic formulations of the first and second laws. General thermodynamic relationships and properties of real substances. Energy, availability, and second law analysis of energy conversion processes. Reaction and multiphase equilibrium. Power generation. Low temperature refrigeration and the third law of thermodynamics. Thermodynamic design. (.3 ED/.7 ES) One course. *Bejan*

205. Biochemical Engineering. (.25 ED/.75 ES) Prerequisite: Mathematics 103. See C-L: Biochemical Engineering 205. One course. *Cherry*

207. Transport Phenomena in Biological Systems. (.25 ED/.75 ES) See C-L: Biochemical Engineering 207; also C-L: Biomedical Engineering 207 and Civil Engineering 207. One course. *Truskey*

208. Introduction to Colloid and Surface Science. This course divides naturally into three sections. The colloid state; classification of colloids and the theoretical frame-

works and experimental techniques involved in their characterization. Interfaces: surface tension and free energy; curved interfaces; adhesion, cohesion and wetting; surface activity; catalytic and mechanical properties of solid surfaces. Inter-Surface Forces: the balance of attractive and repulsive forces which operate between colloidal particles and at macroscopic surfaces. Some emphasis on natural and artificial biomembranes. Consent of instructor required. (1.0 ES) One course. *Needham*

210. Intermediate Dynamics. Comprehensive treatment of space kinematics, kinetics of particles and rigid bodies, generalized coordinates, and Lagrange's equations. Introduction to nonlinear and random dynamic analysis of flexible, continuous systems and stability. (.25 ED / .75 ES) C-L: Civil Engineering 210. One course. *Virgin*

211. Theoretical and Applied Polymer Science. An advanced course in materials science and engineering dealing specifically with the structure and properties of polymers. Particular attention paid to recent developments in the processing and use of modern plastics and fibers. Product design considered in terms of polymer structures, processing techniques, and properties. (.6 ED / .4 ES) C-L: Biomedical Engineering 208. One course. *Clark*

212. Electronic Materials. An advanced course in materials science and engineering dealing with the various materials important for solid-state electronics including semiconductors, ceramics, and polymers. Emphasis on thermodynamic concepts and on defects in these materials. Materials preparation and modification methods for technological applications. (.25 ED / .75 ES) Prerequisite: Engineering 83L. One course. *Gösele or Tan*

214. Corrosion and Corrosion Control. Environmental aspects of the design and utilization of modern engineering alloys. Theory and mechanisms of corrosion, particularly in seawater and atmospheric environments. Microstructural aspects of diffusion, oxidation, hot corrosion, and stress corrosion. (.5 ED / .5 ES) Prerequisite: Engineering 83L. One course. *Jones*

215. Biomedical Materials and Artificial Organs. (.5 ED / .5 ES) See C-L: Biomedical Engineering 215. One course. *Clark*

217. Fracture of Engineering Materials. Conventional design concepts and their relationship to the occurrence of fracture. Linear elastic and general yield fracture mechanics. Microscopic plastic deformation and crack propagation. The relationship between macroscopic and microscopic aspects of fracture. Time dependent fracture. Fracture of specific materials. (.7 ED / .3 ES) Prerequisites: Engineering 83L and Mechanical Engineering 115L. One course. *Jones*

218. Thermodynamics of Electronic Materials. Basic thermodynamic concepts applied to solid state materials with emphasis on technologically relevant electronic materials such as silicon and GaAs. Thermodynamic functions, phase diagrams, solubilities and thermal equilibrium concentrations of point defects; nonequilibrium processes and the kinetic phenomena of diffusion, precipitation, and growth. (.25 ED / .75 ES) One course. *Tan*

221. Compressible Fluid Flow. Basic concepts of the flow of gases from the subsonic to the hypersonic regime. One-dimensional wave motion, the acoustic equations, and waves of finite amplitude. Effects of area change, friction, heat transfer, and shock on one-dimensional flow. Moving and oblique shock waves and Prandtl-Meyer expansion. (.25 ED / .75 ES) One course. *Shaughnessy*

225. Mechanics of Viscous Fluids. Equations of motion for a viscous fluid, general properties and selected solutions of the Navier-Stokes equations, the Stokes equations,

laminar boundary layer equations with selected solutions and approximation techniques, origin of turbulence. (1.0 ES) One course. *Hochmuth*

226. Intermediate Fluid Mechanics. A survey of the principal concepts and equations of fluid mechanics, fluid statics, surface tension, the Eulerian and Lagrangian description, kinematics, Reynolds transport theorem, the differential and integral equations of motion, constitutive equations for a Newtonian fluid, the Navier-Stokes equations, and boundary conditions on velocity and stress at material interfaces. (1.0 ES) One course. *Shaughnessy*

227. Advanced Fluid Mechanics. Flow of a uniform incompressible viscous fluid. Exact solutions to the Navier-Stokes equation. Similarity methods. Irrotational flow theory and its applications. Elements of boundary layer theory. (1.0 ES) Prerequisite: Mechanical Engineering 226 or consent of instructor. One course. *Shaughnessy*

228. Lubrication. Derivation and application of the basic governing equations for lubrication; the Reynolds equation and energy equation for thin films. Analytical and computational solutions to the governing equations. Analysis and design of hydrostatic and hydrodynamic slider bearings and journal bearings. Introduction to the effects of fluid inertia and compressibility. Dynamic characteristics of a fluid film and effects of bearing design on dynamics of machinery. (.25 ED / .75 ES) Prerequisites: Mathematics 111 and Mechanical Engineering 126L. One course. *Knight*

229. Computational Fluid Mechanics and Heat Transfer. An exposition of numerical techniques commonly used for the solution of partial differential equations encountered in engineering physics. Finite-difference schemes (which are well-suited for fluid mechanics problems); notions of accuracy, conservation, consistency, stability, and convergence. Recent applications of weighted residuals methods (Galerkin), finite-element methods, and grid generation techniques. Through specific examples, the student is guided to construct and assess the performance of the numerical scheme selected for the particular type of transport equation (parabolic, elliptic, or hyperbolic). (.5 ED / .5 ES) One course. *Staff*

230. Modern Control and Dynamic Systems. Dynamic modeling of complex linear and nonlinear physical systems involving the storage and transfer of matter and energy. Unified treatment of active and passive mechanical, electrical, and fluid systems. State-space formulation of physical systems. Time and frequency-domain representation. Controllability and observability concepts. System response using analytical and computational techniques. Lyapunov method for system stability. Modification of system characteristics using feedback control and compensation. Emphasis on application of techniques to physical systems. (.25 ED / .75 ES) One course. *Garg*

235. Advanced Mechanical Vibrations. Analytical and experimental procedures applied to the design of machines and systems for adequate vibration control. Determination of eigenvalues and eigenvectors by iteration and computer techniques, transfer matrices applied to lumped and distributed systems, analytical and numerical methods of obtaining the pulse response of plane and three-dimensional multimass systems, convolution and data processing, introduction to random vibration. (.25 ED / .75 ES) One course. *Knight or Wright*

236. Engineering Acoustics. Fundamentals of acoustics including sound generation, propagation, reflection, absorption, and scattering. Emphasis on basic principles and analytical methods in the description of wave motion and the characterization of sound fields. Applications including topics from noise control, sound reproduction, architectural acoustics, and aerodynamic noise. Occasional classroom or laboratory demonstration. (.25 ED / .75 ES) Prerequisites: Engineering 123L and Mathematics 111 or consent of instructor. One course. *Bliss*

237. Aerodynamics. Fundamentals of aerodynamics applied to wings and bodies in subsonic and supersonic flow. Basic principles of fluid mechanics and analytical methods for aerodynamic analysis. Two- and three-dimensional wing theory, slender-body theory, lifting surface methods, vortex and wave drag. Brief introduction to vehicle design, performance, and dynamics. Special topics such as unsteady aerodynamics, vortex wake behavior, and propeller and rotor aerodynamics. (.25 ED/.75 ES) One course. *Bliss*

238. Advanced Aerodynamics. Advanced topics in aerodynamics. Conformal transformation techniques. Three-dimensional wing theory, optimal span loading for planar and nonplanar wings. Ground effect and tunnel corrections. Propeller theory. Slender wing theory and slender body theory, transonic and supersonic area rules for minimization of wave drag. Numerical methods in aerodynamics including source panel and vortex lattice methods. (1.0 ES) Prerequisite: Mechanical Engineering 237. One course. *Hall*

239. Unsteady Aerodynamics. Analytical and numerical methods for computing the unsteady aerodynamic behavior of airfoils and wings. Small disturbance approximation to the full potential equation. Unsteady vortex dynamics. Kelvin impulse and apparent mass concepts applied to unsteady flows. Two-dimensional unsteady thin airfoil theory. Time domain and frequency domain analyses of unsteady flows. Three-dimensional unsteady wing theory. Introduction to unsteady aerodynamic behavior of turbomachinery. (1.0 ES) Prerequisite: Mechanical Engineering 237. One course. *Hall*

240. Patent Technology and Law. The use of patents as a technological data base is emphasized including information retrieval in selected engineering disciplines. Fundamentals of patent law and patent office procedures. Consent of instructor required. (.6 ED/.4 ES) C-L: Law 358. One course. *Cocks*

242. Process Analysis and Design. (1.0 ED) See C-L: Biochemical Engineering 242. One course. *Cherry*

245. Applications in Expert Systems. A comprehensive introduction to the key practical principles, techniques, and tools being used to implement knowledge-based systems. The classic MYCIN system studied in detail to provide historic perspective. Current systems employing combinations of production rules, prototypical knowledge, and frame-based case studies. Student term projects consist of the development of individual, unique expert systems using the Texas Instruments Personal Consultant. Knowledge of LISP not a prerequisite. (.5 ED/.5 ES) One course. *Wright*

252. Buckling of Engineering Structures. (.25 ED/.75 ES) Prerequisite: Civil Engineering 131L or consent of instructor. See C-L: Civil Engineering 252. One course. *Biswas or Virgin*

260. Animal Cell Culture Engineering. (.5 ED/.5 ES) Prerequisite: Biochemical Engineering/Mechanical Engineering 205. See C-L: Biochemical Engineering 260. One course. *Cherry*

265. Advanced Topics in Mechanical Engineering. Opportunity for study of advanced subjects related to programs within mechanical engineering tailored to fit the requirements of a small group. Approval of Director of Undergraduate or Graduate Studies required. Variable credit. *Staff*

268. Cellular and Biosurface Engineering. A combination of fundamental concepts in materials science, colloids, and interfaces that form a basis for characterizing: the physical properties of biopolymers, microparticles, artificial membranes, biological membranes, and cells; and the interactions of these materials at biofluid interfaces. Definition of the subject as a coherent discipline and application of its fundamental

concepts to biology, medicine, and biotechnology. (1.0 ES) Prerequisite: Mechanical Engineering 208 or consent of instructor. One course. *Needham*

270. Robot Control and Automation. Review of kinematics and dynamics of robotic devices; mechanical considerations in design of automated systems and processes, hydraulic and pneumatic control of components and circuits; stability analysis of robots involving nonlinearities; robotic sensors and interfacing; flexible manufacturing; man-machine interaction and safety consideration. (.5 ED/ .5 ES) Prerequisites: Mechanical Engineering 230 or equivalent and consent of instructor. One course. *Garg*

277. Optimization Methods for Mechanical Design. Definition of optimal design. Methodology of constructing quantitative mathematical models. Nonlinear programming methods for finding "best" combination of design variables: minimizing steps, gradient methods, flexible tolerance techniques for unconstrained and constrained problems. Emphasis on computer applications and term projects. Consent of instructor required. (.5 ED/ .5 ES) One course. *Wright*

280. Convective Heat Transfer. Models and equations for fluid motion, the general energy equation, and transport properties. Exact, approximate, and boundary layer solutions for laminar flow heat transfer problems. Use of the principle of similarity and analogy in the solution of turbulent flow heat transfer. Two-phase flow, nucleation, boiling, and condensation heat and mass transfer. (1.0 ES) One course. *Bejan*

281. Conduction and Radiation. Conduction heat transfer in the steady and transient state, in rectangular, cylindrical, and spherical coordinates. Melting and solidification. Radiation exchange involving absorbing and emitting media including gases and flames, combined conduction and radiation, and combined convection and radiation. Exact and approximate methods of solution including separation of variables, transform calculus, numerical procedures, and integral and variational methods. (1.0 ES) One course. *Bejan*

290. Physical Oceanography. Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. (1.0 ES) Prerequisites: Mathematics 31 and 32 or consent of instructor. One course. *Lozier*

COURSES CURRENTLY UNSCHEDULED

113. Introduction to Electronic Materials

216. Materials Science and Solar Technology

224. An Introduction to Turbulence

THE MAJOR

The major requirements are included in the minimum total of thirty-four courses listed under the general requirements and departmental requirements. Specific courses which must be included are Engineering 75L, 83L, and 123L; Mechanical Engineering 101L, 115L, 120L, 126L, 130L, 141L, 150L, and 160L.

Biochemical Engineering (BCE)

Professor Lochmüller, *Director*

Biochemical engineering is a graduate program which offers courses to undergraduates. An undergraduate interdisciplinary program in this area may be arranged on an individual basis. Biochemical engineering broadly comprises the application of plant, animal, or microbial cells to produce or modify other materials, and includes the

processing steps necessary to isolate those products. Engineering of bioprocesses occurs at two levels. The first is classical process design of bioreactors to support cell growth and downstream operations to recover and purify the desired product. The second level, which emerged in the last decade and builds on the enormous recent advances in biology, focuses on understanding and modifying the genetic and metabolic behavior of cells to make them produce or convert materials most effectively. The teaching and research activities of the members of the Center for Biochemical Engineering integrate both aspects of the field. Biochemical engineering has most visibly been applied to the production of natural and recombinant DNA-based pharmaceuticals such as antibiotics, interferon, and human insulin. Other areas of increasing importance include environmental cleanup, biomass conversion for energy, and growth of cells and tissues for medical purposes.

205. Biochemical Engineering. Mathematical analysis of the effects of substrate concentration, pH, temperature, and chemical inhibitors on the rate and yield of biological processes. Enzyme kinetics. Kinetics of cell growth and metabolite production in batch and continuous culture. Design of bioreactors for microbial, mammalian, and plant cell culture. (.25 ED/.75 ES) Prerequisite: Mathematics 103. C-L: Mechanical Engineering 205. One course. *Cherry*

207. Transport Phenomena in Biological Systems. An introduction to the modeling of complex biological systems using principles of transport phenomena and biochemical kinetics. Topics include the conservation of mass and momentum using differential and integral balances; rheology of Newtonian and non-Newtonian fluids; steady and transient diffusion in reacting systems; dimensional analysis; homogeneous versus heterogeneous reaction systems. Biomedical and biotechnological applications are discussed. (.25 ED/.75 ES) C-L: Biomedical Engineering 207, Civil Engineering 207, and Mechanical Engineering 207. One course. *Truskey*

209. Kinetics and Reactor Design. Introduction to chemical and biochemical reaction stoichiometry and kinetics. Concepts of elementary reactions, reaction sequences, steady-state approximations, and rate-limiting steps. Ideal and non-ideal isothermal and non-isothermal reactor design and analysis. Homogeneous and heterogeneous reactor concepts, multiplicity, mass transfer limitations. (.5 ED/.5 ES) Prerequisite: Mathematics 111 or consent of instructor. C-L: Biomedical Engineering 209 and Civil Engineering 209. One course. *Staff*

216. Transport Phenomena in Cells and Organs. Applications of the principles of mass and momentum transport to the analysis of selected processes of biomedical and biotechnological interest. Emphasis on the development and critical analysis of models of the particular transport process. Topics include: reaction-diffusion processes, transport in natural and artificial membranes, dynamics of blood flow, pharmacokinetics, receptor-mediated processes and macromolecular transport, normal and neoplastic tissue. (.5 ED/.5 ES) Prerequisite: Biomedical Engineering 207 or equivalent. C-L: Biomedical Engineering 216. One course. *Truskey*

237. Biosensors. (.5 ED/.5 ES) Prerequisites: Biomedical Engineering 215 and consent of instructor. See C-L: Biomedical Engineering 237. One course. *Reichert*

242. Process Analysis and Design. Combines theory and practical design of continuous processes, with emphasis on chemical and biochemical applications. Design of piping systems, heat exchangers, mixing and agitation. Economic evaluation. Flowsheet synthesis, simulation, and safety reviews. Includes a major design project utilizing these concepts. (1.0 ED) C-L: Mechanical Engineering 242. One course. *Cherry*

244. Applied Microbial Processes. Existing and novel microbial processes as they pertain to biotechnological products, specialty bioconversions, and to treat or exploit wastes. Concepts of microbiology, chemical engineering, the stoichiometry and kinetics of complex microbial metabolism, and process analysis. Specific processes such as carbon oxidation, vinegar and alcohol production, nitrification, methane production, biological electricity generation, recombinant protein secretion, and wastewater treatment in long-term space travel are discussed. Consent of instructor required. (.5 ED / .5 ES) C-L: Civil Engineering 244. One course. *Staff*

260. Animal Cell Culture Engineering. Biological and engineering requirements for the growth of animal cells in vitro, especially on a large scale. Media requirements, kinetics and stoichiometry of cell growth, oxygen supply techniques, bioreactor designs, instrumentation for cell cultures. (.5 ED / .5 ES) Prerequisite: Biochemical Engineering 205. C-L: Mechanical Engineering 260. One course. *Cherry*



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The Bulletin of Duke University, Volume 65, includes the following titles: *The Fuqua School of Business*; *The School of the Environment*; *Undergraduate Instruction*; *The Graduate School*; *The Medical Center*; *The Divinity School*; *Information for Prospective Students*; *The Graduate School* (application bulletin); *The School of Law*; and *Information and Regulations*.

Information that the University is required to make available under the Student Right to Know and Campus Security Acts may be obtained from the Office of University Relations at 684-2823 or in writing at 615 Chapel Drive, Duke University, Durham, North Carolina 27706.

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Calendar of the Graduate School*

Summer 1993†

May	
20	Thursday—Summer Session Term I classes begin.
June	
30	Wednesday—Summer Session Term I final examinations begin.
July	
1	Thursday—Summer Session Term I final examinations end.
5	Tuesday—Summer Session Term II classes begin.
August	
13	Friday—Summer Session Term II final examinations begin.
14	Saturday—Term II final examinations end.

Fall 1993

August	
27	Friday—English examination required for all incoming students whose native language is not English. Examination will begin in Room 139, Social Sciences Building, at 11:00 a.m.
27	Friday—Graduate and Professional School Opening Convocation, 5:00 p.m., Duke Chapel.
30	Monday—Fall semester classes begin at 8:00 a.m.
September	
10	Friday—Last day for drop/add. No late registrations will be taken after this date.
October	
15	Friday—Fall break begins at 6:00 p.m.
20	Wednesday—Classes resume at 8:00 a.m.
November	
1	Monday—Last day for completion of applications to the spring 1994 semester.
24	Wednesday—Thanksgiving recess begins at 12:30 p.m.
29	Monday—Classes resume at 8:00 a.m.
December	
1	Wednesday—Deadline for applications eligible to pay reduced application fee (see application materials), fall 1994.
3	Friday—Graduate classes end at 6:00 p.m.
8	Wednesday—Final date to submit master's theses and Ph.D. dissertations.
4-12	Saturday-Sunday—Graduate reading period; length of 200-level course reading period is determined by the instructor.
12	Sunday—Founders' Day.
13	Monday—Final examinations begin.
17	Friday—Final date for completing degree requirements for an advanced degree to be awarded December 1993. All final copies of examined and signed theses and dissertations must be returned to the Graduate School office by this date.
18	Saturday—Final examinations end.
31	Friday—Deadline for applications to all programs (see application materials), fall 1994.

*The dates in this calendar are subject to change. Information on registration dates is available from the Office of the University Registrar.

†The School of the Environment, the Fuqua School of Business, the Marine Laboratory, and the Department of Physical Therapy have different term lengths and/or starting dates during the summer; consult the appropriate bulletins and schedules.

Spring 1994

January

- 6 Thursday—Spring semester classes begin at 9:00 a.m.
- 8 Saturday—English examination required for all incoming students whose native language is not English from 9:00 a.m.-11:00 a.m. in 109 Languages Building.
- 19 Wednesday—Final day for drop/add. No late registrations will be allowed after January 19.

February

- 1 Tuesday—Final date for filing with the Graduate School office the intention to receive an advanced degree in May.

March

- 4 Friday—Spring recess begins at 6:00 p.m.
- 14 Monday—Classes resume at 8:00 a.m.

April

- 1 Friday—Final date for submitting dissertation for the Ph.D. degree.
- 15 Friday—Final date for submitting theses for master's degrees.
- 23 Friday—Graduate classes end at 6:00 p.m.
- 24-5/2 Saturday-Sunday—Graduate reading period; length of 200-level course reading period is determined by the instructor.
- 22 Friday—Final day for completing degree requirements for an advanced degree to be awarded in May 1994. All final copies of examined and signed theses and dissertations must be returned to the Graduate School office by this date.
- 25 Monday—Final examinations begin.
- 30 Friday—Final examinations end.

May

- 6 Friday—Commencement begins.
- 8 Sunday—Graduation exercises. Conferring of degrees.

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(As of January 1, 1993.)

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 Michele Farrell (1988), Ph.D., *Assistant Professor of Romance Studies*
 Bruce C. Faust (1987), Ph.D., *Assistant Professor of Environmental Studies and Assistant Professor of Civil and Environmental Engineering*
 Richard G. Fehon (1991), Ph.D., *Assistant Professor of Zoology*
 Fred M. Feinberg (1988), Ph.D., *Assistant Professor of Business Administration*
 Michael T. Ferejohn (1983), Ph.D., *Associate Professor of Philosophy*
 Oliver W. Ferguson (1957), Ph.D., *Professor of English*
 Thomas J. Ferraro (1988), Ph.D., *Assistant Professor of English*
 Bernard F. Fetter (1951), M.D., *Professor of Pathology*
 Carol Fierke (1987), Ph.D., *Assistant Professor of Biochemistry*
 Carol Casper Figuers (1990), M.S., *Associate in Physical Therapy*
 Robert L. Fine (1988), M.D., *Assistant Professor of Pharmacology*
 Valeria Finucci (1986), Ph.D., *Assistant Professor of Romance Studies*
 Karla Fischer (1992), Ph.D., *Assistant Professor of Psychology: Social and Health Sciences*
 Peter G. Fish (1969), Ph.D., *Professor of Political Science*
 Stanley Fish (1985), Ph.D., *Arts and Sciences Professor of English*
 Gregory Fisher (1990), Ph.D., *Professor of Business Administration*
 David Fitzpatrick (1983), Ph.D., *Associate Professor of Neurobiology and Adjunct Research Professor of Psychology*
 Joel Fleishman (1971), LL.M., *Professor of Public Policy Studies*
 Carey E. Floyd, Jr. (1989), Ph.D., *Assistant Professor of Biomedical Engineering*
 John D. Forsyth (1978), D.B.A., *Professor of Business Administration*
 Lloyd R. Fortney (1964), Ph.D., *Professor of Physics*
 Richard B. Forward (1971), Ph.D., *Professor of Environmental Studies and Professor of Zoology*
 F. Douglas Foster (1986), Ph.D., *Associate Professor of Business Administration*
 Jennifer Francis (1987), Ph.D., *Assistant Professor of Business Administration*
 Bertram O. Fraser-Reid (1983), Ph.D., *James B. Duke Professor of Chemistry*
 Barbara L. Frederickson (1992), Ph.D., *Assistant Professor of Psychology: Social and Health Sciences*
 Michael Scott Freemark (1990), M.D., *Assistant Professor of Cell Biology*
 Robert T. Freneau, Jr. (1989), Ph.D., *Assistant Professor of Pharmacology and Assistant Professor of Neurobiology*
 Karen Z. Frenzel (1985), Ph.D., *Research Assistant Professor of Electrical Engineering*
 Irwin Fridovich (1958), Ph.D., *James B. Duke Professor of Biochemistry*
 Henry S. Friedman (1992), M.D., *Assistant Professor of Pathology*
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 V. A. Funk (1992), Ph.D., *Adjunct Associate Professor of Botany*
 Jane Marie Gaines (1982), Ph.D., *Assistant Professor of English*
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 Carl L. Gardner (1986), Ph.D., *Associate Professor of Computer Science*
 Devendra P. Garg (1972), Ph.D., *Professor of Mechanical Engineering and Materials Science*
 D. Barry Gaspar (1983), Ph.D., *Professor of History*
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 Michael Steven Hershfield (1976), M.D., Assistant Professor of Biochemistry
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 Robert L. Hill (1961), Ph.D., James B. Duke Professor of Biochemistry
 Hans Hillerbrand (1959-1970; 1988), Ph.D., Professor of Religion
 Michael Lee Hines (1978), Ph.D., Associate Research Professor of Neurobiology
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 Mark A. Holliday (1986), Ph.D., Assistant Professor of Computer Science
 Edward V. Holmes (1987), M.D., Associate Professor of Biochemistry
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 Joel C. Huber (1978), Ph.D., Associate Professor of Business Administration
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 Alexander Hull (1962), Ph.D., Associate Professor of Romance Studies
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 Raymond E. Ideker (1978), M.D., Ph.D., Professor of Pathology and Professor of Biomedical Engineering
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 Fredric R. Jameson (1985), Ph.D., William A. Lane Professor of Romance Studies and Professor of Literature
 Micaela W. Janan (1990), Ph.D., Assistant Professor of Classical Studies
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 Robert B. Jennings (1975), M.D., James B. Duke Professor of Pathology
 Randy L. Jirtle (1977), Ph.D., Assistant Professor of Pathology
 Frans F. Jöbsis (1964), Ph.D., Professor of Cell Biology
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 Valen Johnson (1990), Ph.D., Assistant Professor of Statistics
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 William W. Johnston (1963), M.D., Professor of Pathology
 William Thomas Joines (1966), Ph.D., Professor of Electrical Engineering
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 Lawrence C. Katz (1990), Ph.D., Associate Professor of Neurobiology
 Julie A. Kauer (1991), Ph.D., Assistant Professor of Neurobiology
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 Russel Kaufman (1984), Ph.D., Assistant Professor of Biochemistry
 Richard F. Kay (1973), Ph.D., Professor of Biological Anthropology and Anatomy
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 Allen C. Kelley (1972), Ph.D., *James B. Duke Professor of Economics*
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 Daniel Kiehart (1992), Ph.D., *Assistant Professor of Cell Biology*
 Kent P. Kimbrough (1980), Ph.D., *Professor of Economics*
 Anna Kirmani (1988), Ph.D., *Assistant Professor of Business Administration*
 Norman Kirshner (1956), Ph.D., *Professor of Pharmacology and Professor of Biochemistry*
 Naoki Kishimoto (1987), Ph.D., *Assistant Professor of Business Administration*
 Joseph Weston Kitchen, Jr. (1962), Ph.D., *Associate Professor of Mathematics*
 Herbert P. Kitschelt (1984), Ph.D., *Professor of Political Science*
 Emily M. Klein (1988), Ph.D., *Assistant Professor of Geology*
 Gordon K. Klintworth (1964), M.D., Ph.D., *Professor of Pathology*
 Bruce Maurice Klitzman (1989), Ph.D., *Assistant Medical Research Professor of Cell Biology*
 Peter H. Klopfer (1958), Ph.D., *Professor of Zoology*
 Josiah Doss Knight (1985), Ph.D., *Associate Professor of Mechanical Engineering and Materials Science*
 Kenneth R. Knoerr (1961), Ph.D., *Professor of Environmental Studies and Associate Professor of Botany*
 John A. Koepke (1979), M.D., *Professor of Pathology*
 Bruce D. Kohorn (1987), Ph.D., *Assistant Professor of Botany*
 Claudia Koonz (1988), Ph.D., *Associate Professor of History*
 J. Mailen Kootsey (1971-76; 1979), Ph.D., *Associate Professor of Cell Biology and Research Associate Professor of Computer Science*
 David Kopf (1988), Ph.D., *Adjunct Assistant Professor of Cell Biology*
 Allan Kornberg (1965), Ph.D., *Professor of Political Science*
 Wesley A. Kort (1965), Ph.D., *Professor of Religion*
 Panagiotis Kouvelis (1991), Ph.D., *Associate Professor of Business Administration*
 David Paul Kraines (1970), Ph.D., *Associate Professor of Mathematics*
 Randall A. Kramer (1988), Ph.D., *Associate Professor of Environmental Studies*
 Michael Steven Krangel (1990), Ph.D., *Associate Professor of Immunology*
 Wilmer L. Kranich (1986), Ph.D., *Adjunct Professor of Civil and Environmental Engineering*
 Wanda Krassowska (1991), Ph.D., *Research Assistant Professor of Biomedical Engineering*
 Nicholas Michael Kredich (1968), M.D., *Professor of Biochemistry*
 John Kress (1992), Ph.D., *Adjunct Associate Professor of Botany*
 Kenneth N. Kreuzer (1984), Ph.D., *Associate Professor of Microbiology*
 Jeffrey L. Krolik (1992), Ph.D., *Associate Professor of Electrical Engineering*
 Anne O. Krueger (1986), Ph.D., *Arts and Sciences Distinguished Professor of Economics*
 Cynthia Moreton Kuhn (1978), Ph.D., *Associate Professor of Pharmacology and Associate Professor of Psychology: Experimental*
 Bruce R. Kuniholm (1977), Ph.D., *Professor of Public Policy Studies and Professor of History*
 Thomas A. Kunkel (1986), Ph.D., *Adjunct Professor of Genetics*
 Albert S. Kyle (1992), Ph.D., *Associate Professor of Business Administration*
 Helen F. Ladd (1986), Ph.D., *Professor of Public Policy Studies and Adjunct Professor of Economics*
 Thomas C. Lahusen (1989), Ph.D., *Associate Professor of Slavic Languages and Literatures*
 Martin Lakin (1958), Ph.D., *Professor of Psychology*
 Anthony LaMantia (1990), Ph.D., *Assistant Professor of Neurobiology*
 Michael K. Lamvik (1982), Ph.D., *Research Assistant Professor of Cell Biology*
 Kenneth C. Land (1985), Ph.D., *John Franklin Crowell Professor of Sociology*
 Peter Lange (1982), Ph.D., *Professor of Political Science*
 Thomas A. Langford (1956), Ph.D., *Professor of Religion, Systematic Theology*
 Paul J. Lanzkron (1991), Ph.D., *Assistant Professor of Computer Science*
 Anselmo A. Lastra (1988), Ph.D., *Research Assistant Professor of Computer Science*
 Dan Laughhunn (1968-75; 1976), D.B.A., *Professor of Business Administration*
 Cathy C. Laurie (1986), Ph.D., *Professor of Zoology*
 Tod A. Laursen (1992), Ph.D., *Assistant Professor of Civil and Environmental Engineering*
 Michael Lavine (1990), Ph.D., *Assistant Professor of Statistics*
 Gregory F. Lawler (1979), Ph.D., *Professor of Mathematics*
 Bruce B. Lawrence (1971), Ph.D., *Professor of Religion*
 Harold E. Layton (1988), Ph.D., *Assistant Professor of Mathematics*
 Alfred McClung Lee, IV (1992), Ph.D., *Assistant Professor of Physics*
 Robert Lefkowitz (1973), M.D., *James B. Duke Professor of Biochemistry*
 Ann E. LeFurgey (1976), Ph.D., *Assistant Professor of Cell Biology*
 James Leitzel (1990), Ph.D., *Associate Professor of Public Policy Studies*
 Frank Lentricchia (1984), Ph.D., *Katharine Everett Gilbert Professor of English and Professor of Literature*

Warren Lerner (1961), Ph.D., *Professor of History*
 Arie Y. Lewin (1974), Ph.D., *Professor of Business Administration and Professor of Sociology*
 Darrell Vincent Lewis (1978), M.D., *Assistant Professor of Neurobiology*
 James Grier Lewis (1991), Ph.D., *Assistant Professor of Pathology*
 Melvyn Lieberman (1968), Ph.D., *Professor of Cell Biology*
 Virginia Ann Lightner (1989), M.D., Ph.D., *Assistant Professor of Cell Biology*
 Nan Lin (1989), Ph.D., *Professor of Sociology*
 C. Eric Lincoln (1976), Ph.D., William R. Kenan, Jr. *Professor of Religion*
 Marcia Lind (1988), Ph.D., *Assistant Professor of Philosophy*
 Frederick W. Lindahl (1985), Ph.D., *Associate Professor of Business Administration*
 Scott A. Lindroth (1991), D.M.A., *Assistant Professor of Music*
 Elwood A. Linney (1984), Ph.D., *Associate Professor of Microbiology*
 Patricia Linville (1990), Ph.D., *Associate Professor of Business Administration*
 Joseph Lipscomb, Jr. (1974), Ph.D., *Associate Professor of Public Policy Studies*
 Vladimir N. Litvinenko (1991), Ph.D., *Research Associate Professor of Physics*
 Daniel A. Livingstone (1956), Ph.D., James B. Duke *Professor of Zoology*
 Donald C. Lo (1992), Ph.D., *Assistant Professor of Neurobiology*
 Bruce Lobaugh (1988), Ph.D., *Assistant Medical Research Professor of Cell Biology*
 John E. Lochman (1984), Ph.D., *Associate Professor of Psychology: Social and Health Sciences*
 Charles H. Lochmüller (1969), Ph.D., *Professor of Chemistry, Professor of Biomedical Engineering, and Professor of Biochemical Engineering*
 Gregory R. Lockhead (1965), Ph.D., *Professor of Psychology: Experimental*
 Timothy J. Lomperis (1984), Ph.D., *Assistant Professor of Political Science*
 Donald W. Loveland (1973), Ph.D., *Professor of Computer Science*
 John G. Lundberg (1970), Ph.D., *Professor of Zoology*
 Richard A. MacPhail (1984), Ph.D., *Assistant Professor of Chemistry*
 John M. McCann (1978), Ph.D., *Associate Professor of Business Administration*
 Kevin F. McCadle (1985), Ph.D., *Associate Professor of Business Administration*
 David R. McClay (1973), Ph.D., *Professor of Zoology, Professor of Immunology, and Professor of Neurobiology*
 John B. McConahay (1974), Ph.D., *Associate Professor of Public Policy Studies*
 Dean E. McCumber (1992), Ph.D., *Visiting Professor of Electrical Engineering*
 James H. McElhaney (1973), Ph.D., *Professor of Biomedical Engineering*
 Marjorie McElroy (1970), Ph.D., *Professor of Economics*
 Linda McGown (1987), Ph.D., *Professor of Chemistry*
 Thomas J. McIntosh (1977), Ph.D., *Professor of Cell Biology*
 Margaret A. McKean (1974), Ph.D., *Associate Professor of Political Science*
 Thomas J. McManus (1961), M.D., *Professor of Cell Biology*
 James O. McNamara (1973), M.D., *Professor of Neurobiology and Associate Professor of Pharmacology*
 Andrew T. McPhail (1968), Ph.D., *Professor of Chemistry*
 Mary Maas (1989), Ph.D., *Assistant Professor of Biological Anthropology and Anatomy*
 George L. Maddox, Jr. (1960), Ph.D., *Professor of Sociology*
 John M. J. Madey (1988), Ph.D., *Professor of Physics*
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 Wesley A. Magat (1974), Ph.D., *Professor of Business Administration and Professor of Public Policy Studies*
 Alan David Magid (1989), Ph.D., *Assistant Medical Research Professor of Cell Biology*
 Lynn A. Maguire (1982), Ph.D., *Assistant Professor of Environmental Studies*
 Edward P. Mahoney (1965), Ph.D., *Professor of Philosophy*
 Laureen A. Maines (1990), Ph.D., *Assistant Professor of Business Administration*
 Peter E. Malin (1991), Ph.S., D.Sc., *Associate Professor of Geology*
 Terry Malone (1987), Ed.D., *Associate Professor of Physical Therapy*
 Lazaro J. Mandel (1972), Ph.D., *Professor of Cell Biology*
 Kenneth G. Manton (1977), Ph.D., *Research Professor of Sociology*
 Peter N. Marinos (1968), Ph.D., *Professor of Electrical Engineering and Professor of Computer Science*
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 Gail R. Marsh (1969), Ph.D., *Adjunct Associate Professor of Psychology: Experimental*
 Robert C. Marshall (1983), Ph.D., *Associate Professor of Economics*
 Dale Martin (1988), Ph.D., *Assistant Professor of Religion*
 Hisham Z. Massoud (1983), Ph.D., *Associate Professor of Electrical Engineering*
 William D. Matthew (1990), Ph.D., *Associate Professor of Neurobiology*
 Seymour H. Mauskopf (1964), Ph.D., *Professor of History*
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 Michael J. Meurer (1985), Ph.D., J.D., *Assistant Professor of Economics*
 Johannes Horst Max Meyer (1959), Ph.D., *Professor of Physics*
 Tobias Meyer (1991), Ph.D., *Assistant Professor of Cell Biology*
 Carol L. Meyers (1979), Ph.D., *Professor of Religion*
 Eric M. Meyers (1969), Ph.D., *Professor of Religion*
 George Michalopoulos (1977), M.D., Ph.D., *Professor of Pathology*
 Martin A. Miller (1970), Ph.D., *Professor of History*
 Sara Elizabeth Miller (1973), Ph.D., *Associate Medical Research Professor of Microbiology*
 Elliott Mills (1968), Ph.D., *Professor of Pharmacology and Associate Professor of Cell Biology*
 Marie Lynn Miranda (1990), Ph.D., *Assistant Professor of Public Policy Studies*
 Brent Drennen Mishler (1984), Ph.D., *Associate Professor of Botany*
 Thomas G. Mitchell (1974), Ph.D., *Associate Professor of Microbiology*
 Paul L. Modrich (1976), Ph.D., *James B. Duke Professor of Biochemistry*
 Toril Moi (1992), (Ph.D.), *Professor of Romance Studies and Professor of Literature*
 Michael Moon (1987), Ph.D., *Assistant Professor of English*
 Lawrence C. Moore, Jr. (1966), Ph.D., *Associate Professor of Mathematics*
 Marian Chapman Moore (1982), Ph.D., *Associate Professor of Business Administration*
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 Alberto Moreiras (1992), Ph.D., *Visiting Assistant Professor of Romance Studies*
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 David R. Morrison (1986), Ph.D., *Professor of Mathematics*
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 Michael Moses (1987), Ph.D., *Assistant Professor of English*
 Montrose J. Moses (1959), Ph.D., *Professor of Cell Biology*
 Hervé Moulin (1989), Ph.D., *James B. Duke Professor of Economics and Research Professor of Statistics*
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 Valentin Mudimbe (1987), Ph.D., *Ruth F. DeVarney Professor of Romance Studies, Professor of Literature, and Professor of Cultural Anthropology*
 Peter Müller (1991), Ph.D., *Assistant Professor of Statistics*
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 Barry S. Myers (1991), Ph.D., *Assistant Professor of Biomedical Engineering*
 George C. Myers (1968), Ph.D., *Professor of Sociology*
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 J. Victor Nadler (1978), Ph.D., *Professor of Pharmacology and Associate Professor of Neurobiology*
 Purushottaman Nandakumar (1991), Ph.D., *Assistant Professor of Business Administration*
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 Kristen B. Neuschel (1982), Ph.D., *Associate Professor of History*
 Joseph Nevins (1987), Ph.D., *Professor of Microbiology*
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 Robert Bruce Nicklas (1965), Ph.D., *Professor of Zoology and Professor of Cell Biology*
 Frederik Nijhout (1977), Ph.D., *Professor of Zoology*
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 Fearghus O'Foghlu (1975), Ph.D., *Adjunct Professor of Physics*
 Seog Hwan Oh (1984), Ph.D., *Associate Professor of Physics*
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 Harry B. Partin (1964), Ph.D., *Associate Professor of Religion*
 Eric I. Pas (1980), Ph.D., *Associate Professor of Civil and Environmental Engineering*
 Ares D. Pasipoularides (1989), M.D., Ph.D., *Associate Professor of Biomedical Engineering*
 Merrell Lee Patrick (1964), Ph.D., *Professor of Computer Science*
 Annabel M. Patterson (1986), Ph.D., *Professor of English and Professor of Literature*
 David T. Patterson (1980), Ph.D., *Adjunct Associate Professor of Botany*
 Lee Patterson (1986), Ph.D., *Professor of English*
 John W. Payne (1977), Ph.D., *Professor of Business Administration and Professor of Psychology: Experimental*
 George Wilbur Pearsall (1964), Sc.D., *Professor of Mechanical Engineering and Materials Science and Professor of Public Policy Studies*
 J. Jeffrey Peirce (1981), Ph.D., *Associate Professor of Civil and Environmental Engineering*
 Ann Marie Pendergast (1992), Ph.D., *Assistant Professor of Pharmacology*
 Gustavo Pérez-Firmat (1978), Ph.D., *Professor of Romance Studies*
 Ronald D. Perkins (1968), Ph.D., *Professor of Geology*
 Melvin K. H. Peters (1983), Ph.D., *Associate Professor of Religion*
 David West Peterson (1986), Ph.D., *Adjunct Professor of Business Administration*
 Henry J. Petroski (1980), Ph.D., *Professor of Civil Engineering*
 David J. Pickup (1984), Ph.D., *Assistant Professor of Microbiology*
 Orrin Pilkey (1965), Ph.D., *James B. Duke Professor of Geology and Professor of Environmental Studies*
 Michael C. Pirrung (1991), Ph.D., *Associate Professor of Chemistry*
 David Stephen Pisetsky (1978), M.D., Ph.D., *Assistant Professor of Immunology*
 Salvatore V. Pizzo (1976), M.D., Ph.D., *Professor of Pathology*
 Robert Plonsey (1983), Ph.D., *Professor of Biomedical Engineering and Professor of Cell Biology*
 Richard P. Polniaszek (1986), Ph.D., *Assistant Professor of Chemistry*
 Deborah Pope (1979), Ph.D., *Associate Professor of English*
 Joseph A. Porter (1980), Ph.D., *Associate Professor of English*
 Ned Allen Porter (1969), Ph.D., *James B. Duke Professor of Chemistry*
 Carl J. Posy (1981), Ph.D., *Associate Professor of Philosophy*
 Philip Pratt (1966), M.D., *Professor of Pathology*
 Vernon G. Pratt (1964), M.F.A., *Associate Professor of Art*
 David Eugene Price (1973), Ph.D., *Professor of Political Science and Professor of Public Policy Studies*
 Reynolds Price (1958), D.Litt., *Professor of English*
 Michael G. Prisant (1988), Ph.D., *Assistant Professor of Chemistry*
 Alan Proia (1989), Ph.D., *Assistant Professor of Pathology*
 Stefan Pugh (1981), Ph.D., *Associate Professor of Slavic Languages and Literatures*
 Devavrat Purohit (1988), Ph.D., *Associate Professor of Business Administration*
 Dale Purves (1990), M.D., *George B. Geller Professor of Neurobiology*
 Martha Putallaz (1983), Ph.D., *Associate Professor of Psychology: Experimental and Associate Professor of Psychology: Social and Health Sciences*
 Alician Veronica Quinlan (1983), Ph.D., *Associate Professor of Mechanical Engineering and Materials Science, Associate Professor of Environmental Engineering, and Associate Professor of Biochemical Engineering*
 Naomi Quinn (1972), Ph.D., *Associate Professor of Cultural Anthropology*
 K. V. Rajagopalan (1966), Ph.D., *Professor of Biochemistry*
 Dietolf Ramm (1971), Ph.D., *Research Associate Professor of Computer Science*
 Joseph S. Ramus (1978), Ph.D., *Professor of Environmental Studies, Director of the Duke University Marine Laboratory, and Professor of Botany*
 Dale B. J. Randall (1957), Ph.D., *Professor of English*
 Elizabeth Rapaport (1988), Ph.D., *Associate Professor of Public Policy Studies*
 Ann Marie Rasmussen (1988), Ph.D., *Assistant Professor of Germanic Languages and Literature*
 Mark D. Rausher (1978), Ph.D., *Professor of Zoology*
 Kenneth H. Reckhow (1980), Ph.D., *Associate Professor of Environmental Studies and Associate Professor of Statistics*
 William M. Reddy (1977), Ph.D., *Professor of History and Professor of Cultural Anthropology*

Mark Reed (1989), Ph.D., Assistant Professor of Sociology
 Michael Charles Reed (1974), Ph.D., Professor of Mathematics
 Michael K. Reedy (1969), M.D., Professor of Cell Biology
 William Reichert (1987), Ph.D., Assistant Professor of Biomedical Engineering and Assistant Professor of Biochemical Engineering
 John H. Reif (1986), Ph.D., Professor of Computer Science
 Keith Arnold Reimer (1975), M.D., Ph.D., Associate Professor of Pathology
 Peter H. Reinhart (1991), Ph.D., Assistant Professor of Neurobiology
 Michael A. Resnick (1985), Ph.D., Adjunct Professor of Genetics
 James F. Reynolds (1991), Ph.D., Professor of Botany
 Jean-François Richard (1990), Professor of Statistics
 John F. Richards (1977), Ph.D., Professor of History
 Curtis J. Richardson (1977), Ph.D., Professor of Environmental Studies
 David Claude Richardson (1969), Ph.D., Professor of Biochemistry
 Jane Richardson (1970), M.A.T., Medical Research Professor of Biochemistry
 Russell Richey (1987), Ph.D., Research Professor of Religion, Church History
 Daniel D. Richter (1987), Ph.D., Associate Professor of Environmental Studies
 Stephen J. Riederer (1983), Ph.D., Associate Professor of Biomedical Engineering
 Kent J. Rigsby (1971), Society of Fellows (Harvard), Associate Professor of Classical Studies
 Mary Ellen Riordan (1978), M.S., Assistant Clinical Professor of Physical Therapy
 Nathan Russell Roberson (1963), Ph.D., Professor of Physics
 Darryl Lamont Roberts (1984), Ph.D., Assistant Professor of Political Science
 Hugh G. Robinson (1964), Ph.D., Professor of Physics
 Sandra P. Robinson (1983), Ph.D., Assistant Professor of Religion
 Thomas Robisheaux (1984), Ph.D., Associate Professor of History
 Herman R. Robl (1959-64; 1966), Ph.D., Adjunct Professor of Physics
 Marshall R. Roderick (1985), Ph.D., Assistant Professor of Philosophy
 Stuart Rojstaczer (1990), Ph.D., Assistant Professor of Geology and Assistant Professor of Environmental Studies
 Alex Roland (1981), Ph.D., Professor of History
 James L. Rolleston (1975), Ph.D., Professor of Germanic Languages and Literature
 Donald J. Rose (1984), Ph.D., Professor of Computer Science and Professor of Mathematics
 Allen D. Roses (1968), M.D., Professor of Neurobiology
 Elizabeth Fromm Ross (1991), M.S., Clinical Associate in Physical Therapy
 Kathleen A. Ross (1984), Ph.D., Associate Professor of Romance Studies
 Wendell F. Rosse (1966), M.D., Professor of Immunology
 Aleda V. Roth (1991), Ph.D., Associate Professor of Business Administration
 Susan Roth (1973), Ph.D., Associate Professor of Psychology
 Virginia Louise Roth (1983), Ph.D., Associate Professor of Zoology and Associate Professor of Biological Anthropology and Anatomy
 David C. Rubin (1978), Ph.D., Professor of Psychology: Experimental
 Jeffrey Rummel (1986), Ph.D., Associate Professor of Business Administration
 Clyde de Loache Ryals (1973), Ph.D., Professor of English
 Jerome Sacks (1992), Ph.D., Professor of Statistics
 Harvey J. Sage (1964), Ph.D., Associate Professor of Biochemistry and Associate Professor of Immunology
 Patricia M. Saling (1991), Ph.D., Associate Professor of Cell Biology
 Jane E. Salk (1991), Ph.D., Assistant Professor of Business Administration
 Guy Selmer Salvesen (1991), Ph.D., Assistant Professor of Pathology
 Ed Parish Sanders (1991), Ph.D., Professor of Religion
 Alfred Paul Sanfilippo (1979), M.D., Ph.D., Adjunct Professor of Pathology and Professor of Immunology
 David H. Sanford (1970), Ph.D., Professor of Philosophy
 Leslie D. Saper (1986), Ph.D., Associate Professor of Mathematics
 Rakesh Sarin (1987), Ph.D., Professor of Business Administration
 Diane Sasson (1987), Ph.D., Director, Master of Arts in Liberal Studies Program and Director, Master of Arts in Teaching Program
 Robert N. Sawyer (1976), Ed.D., Associate Professor of Education
 Frederick H. Schachat (1977), Ph.D., Associate Professor of Cell Biology
 David G. Schaeffer (1978), Ph.D., James B. Duke Professor of Mathematics
 Saul M. Schanberg (1967), M.D., Ph.D., Professor of Pharmacology
 Margaret Schenkman (1991), Ph.D., Associate Professor of Physical Therapy
 Shirish Shenolikar (1992), Ph.D., Associate Professor of Pharmacology
 Susan S. Schiffman (1972), Ph.D., Professor of Psychology: Experimental
 William H. Schlesinger (1980), Ph.D., Professor of Botany
 David M. Schlossman (1979), M.D., Ph.D., Assistant Professor of Biochemistry
 Klaus Schmidt-Koenig (1983), Ph.D., Adjunct Professor of Zoology
 Chadmark L. Schoen (1982), Ph.D., Associate Professor of Mathematics
 Stanley Clifford Schold, Jr. (1978), M.D., Assistant Professor of Pathology

David W. Schomberg (1968), Ph.D., *Associate Professor of Cell Biology*
 Naomi Schor (1988), Ph.D., *William Wannamaker Professor of Romance Studies*
 Regina Schwartz (1987), Ph.D., *Associate Professor of English and Associate Professor of Religion*
 Rochelle D. Schwartz (1986), Ph.D., *Associate Professor of Pharmacology*
 Julius S. Scott (1988), Ph.D., *Assistant Professor of History*
 William E. Scott (1958), Ph.D., *Professor of History*
 Richard A. Scoville (1961), Ph.D., *Associate Professor of Mathematics*
 Richard B. Searles (1965), Ph.D., *Professor of Botany*
 Eve K. Sedgwick (1988), Ph.D., *Professor of English*
 Tilman Seebass (1977), Ph.D., *Professor of Music*
 Hilliard Foster Seigler (1967), M.D., *Professor of Microbiology and Immunology*
 Michael Forrest Seldin (1990), M.D., Ph.D., *Assistant Professor of Microbiology*
 Edward J. Shaughnessy (1975), Ph.D., *Professor of Mechanical Engineering and Materials Science*
 Barbara Ramsay Shaw (1975), Ph.D., *Professor of Chemistry*
 Michael P. Sheetz (1990), Ph.D., *Professor of Cell Biology*
 John Shelburne (1973), M.D., Ph.D., *Professor of Pathology*
 Marion L. Shepard (1967), Ph.D., *Professor of Mechanical Engineering and Materials Science*
 Blair H. Sheppard (1981), Ph.D., *Associate Professor of Business Administration*
 Stephanie Sieburth (1987), Ph.D., *Associate Professor of Romance Studies*
 James N. Siedow (1976), Ph.D., *Professor of Botany*
 Lewis M. Siegel (1968), Ph.D., *Professor of Biochemistry*
 Alexander Silbiger (1984), Ph.D., *Professor of Music*
 Sidney Arthur Simon (1973), Ph.D., *Professor of Neurobiology*
 Elwyn L. Simons (1977), Ph.D., D.Phil., *James B. Duke Professor of Biological Anthropology and Anatomy and Professor of Zoology*
 Ida Harper Simpson (1959), Ph.D., *Professor of Sociology*
 William R. Sizemore (1982), Ph.D., *Adjunct Professor of Environmental Studies*
 David Skatrud (1990), Ph.D., *Adjunct Associate Professor of Physics*
 J. H. Pate Skene (1991), Ph.D., *Associate Professor of Neurobiology*
 Theodore Alan Slotkin (1971), Ph.D., *Professor of Pharmacology and Professor of Neurobiology*
 Barbara Herrnstein Smith (1987), Ph.D., *Braxton Craven Professor of Literature and English*
 D. Moody Smith (1965), Ph.D., *George Washington Ivey Professor of Religion, New Testament Interpretation*
 David A. Smith (1962), Ph.D., *Associate Professor of Mathematics*
 Grover C. Smith (1952), Ph.D., *Professor of English*
 Harmon L. Smith (1959), Ph.D., *Professor of Religion, Moral Theology*
 James E. Smith (1990), Ph.D., *Assistant Professor of Business Administration*
 Joel Smith (1958), Ph.D., *Professor of Sociology*
 Kathleen K. Smith (1980), Ph.D., *Associate Professor of Biological Anthropology and Anatomy and Associate Professor of Zoology*
 Peter Smith (1959), Ph.D., *Professor of Chemistry*
 Steven Smith (1988), Ph.D., *Assistant Professor of Public Policy Studies and Assistant Professor of Political Science*
 Stephen William Smith (1990), Ph.D., *Associate Professor of Biomedical Engineering*
 Thomas M. Smith (1990), Ph.D., *Associate Professor of Business Administration*
 Joshua E. S. Socolar (1992), Ph.D., *Assistant Professor of Physics*
 Helen Solterer (1986), Ph.D., *Assistant Professor of Romance Studies*
 George G. Somjen (1964), M.D., *Professor of Cell Biology and Professor of Neurobiology*
 Joachim R. Sommer (1957), M.D., *Professor of Pathology and Professor of Cell Biology*
 Harris Sondak (1990), Ph.D., *Assistant Professor of Business Administration*
 Madison S. Spach (1958), M.D., *Professor of Cell Biology*
 Kenneth I. Spenner (1984), Ph.D., *Associate Professor of Sociology*
 Leonard Spicer (1984), Ph.D., *Professor of Biochemistry*
 Thomas Arthur Spragens, Jr. (1967), Ph.D., *Professor of Political Science*
 Roxanne P. Springer (1992), Ph.D., *Assistant Professor of Physics*
 John E. R. Staddon (1967), Ph.D., *James B. Duke Professor of Psychology: Experimental, Professor of Neurobiology, and Professor of Zoology*
 Richard Staelin (1982), Ph.D., *Edward and Rose Donnell Professor of Business Administration*
 William J. Stambaugh (1961), Ph.D., *Professor of Environmental Studies*
 Dennis Keith Stanley (1961), Ph.D., *Associate Professor of Classical Studies*
 Charles Franklin Starmer, Jr. (1966), Ph.D., *Professor of Computer Science*
 Dalene K. Stangl (1992), Ph.D., *Assistant Professor of Statistics*
 Orin Starn (1991), Ph.D., *Assistant Professor of Cultural Anthropology*
 Deborah A. Steege (1977), Ph.D., *Professor of Biochemistry*
 Harold K. Steen (1985), Ph.D., *Adjunct Professor of Environmental Studies*
 David Curtis Steinmetz (1971), Th.D., *Professor of Religion, Church History and Doctrine*
 Mark Andrew Stern (1985), Ph.D., *Professor of Mathematics*
 Philip Stewart (1972), Ph.D., *Professor of Romance Studies*

Kristine Stiles (1988), Ph.D., Assistant Professor of Art History
 Donald E. Stone (1963), Ph.D., Professor of Botany
 Boyd R. Strain (1969), Ph.D., Professor of Botany
 Victor H. Strandberg (1966), Ph.D., Professor of English
 Claudia Strauss (1990), Ph.D., Assistant Professor of Cultural Anthropology
 Harold Carl Strauss (1972), M.D., Professor of Pharmacology
 Richard A Strelitz (1984), Ph.D., Assistant Professor of Geology
 Warren James Strittmatter (1991), M.D., Associate Professor of Neurobiology
 Norman C. Strole (1986), Ph.D., Adjunct Assistant Professor of Electrical Engineering
 Akio Sugino (1986), Ph.D., Adjunct Assistant Professor of Genetics
 Tai-ping Sun (1991), Ph.D., Assistant Professor of Botany
 Kenneth Surin (1987), Ph.D., Associate Professor of Religion and Associate Professor of Literature
 Richard S. Surwit (1991), Ph.D., Professor of Psychology: Social and Health Sciences
 John P. Sutherland (1969), Ph.D., Professor of Environmental Studies and Professor of Zoology
 James A. Swenberg (1979), D.V.M., Ph.D., Adjunct Associate Professor of Pathology
 Deborah L. Swenson (1990), Ph.D., Assistant Professor of Business Administration
 Avis L. Sylvia (1977), Ph.D., Associate Medical Research Professor of Cell Biology
 Teh Yu Tan (1986), Ph.D., Professor of Mechanical Engineering and Materials Science
 George E. Tauchen (1977), Ph.D., Professor of Economics
 Roger Trans-Son Tay (1987), Ph.D., Research Assistant Professor of Mechanical Engineering and Materials Science
 Kenneth Allen Taylor (1980), Ph.D., Associate Medical Research Professor of Cell Biology
 John J. TePaske (1967), Ph.D., Professor of History
 Stephen W. Teitsworth (1988), Ph.D., Assistant Professor of Physics and Assistant Professor of Electrical Engineering
 John Terborgh (1989), Ph.D., James B. Duke Professor of Environmental Science, Professor of Biological Anthropology and Anatomy, and Professor of Zoology
 Marcel Tetel (1960), Ph.D., Professor of Romance Studies
 Jean-Jacques Thomas (1981), Doctorat de 3e Cycle, Professor of Romance Studies and Professor of Literature
 John E. Thomas (1987), Ph.D., Professor of Physics
 John H. Thompson (1991), Ph.D., Professor of History
 Robert J. Thompson, Jr. (1984), Ph.D., Adjunct Professor of Psychology
 Susan Thorne (1991), Ph.D., Assistant Professor of History
 Fredrick L. Thurstone (1967), Ph.D., Research Professor of Biomedical Engineering
 Edward A. Tiryakian (1965), Ph.D., Professor of Sociology
 Margaret A. Titus (1990), Ph.D., Assistant Professor of Cell Biology
 R. Larry Todd (1978), Ph.D., Professor of Music
 Jane Tompkins (1985), Ph.D., Professor of English
 Eric J. Toone (1991), Ph.D., Assistant Professor of Chemistry
 Marianna Torgovnick (1981), Ph.D., Professor of English
 Werner Tornow (1988), Ph.D., Research Associate Professor of Physics
 Edward Tower (1974), Ph.D., Professor of Economics
 Gregg E. Trahey (1985), Ph.D., Associate Professor of Biomedical Engineering
 John A. Trangenstein (1991), Ph.D., Associate Professor of Mathematics
 Vladimir G. Trembl (1967), Ph.D., Professor of Economics
 Kishor S. Trivedi (1975), Ph.D., Professor of Computer Science and Professor of Electrical Engineering
 George Truskey (1987), Ph.D., Assistant Professor of Biomedical Engineering and Assistant Professor of Biochemical Engineering
 Vance Tucker (1964), Ph.D., Professor of Zoology
 Clare Tufts (1987), Ph.D., Lecturer and Coordinator of Language Instruction in Romance Studies
 William Turner (1987), Ph.D., Assistant Professor of Religion, Theology and Black Church Studies
 E. Lee Tyrey (1970), Ph.D., Associate Professor of Neurobiology
 Bisulay Utku (1987), Ph.D., Adjunct Associate Professor of Civil and Environmental Engineering
 Senol Utku (1970), Sc.D., Professor of Civil and Environmental Engineering and Professor of Computer Science
 Marcy K. Uyenoyama (1982), Ph.D., Associate Professor of Zoology
 Rebecca Van Beneden (1988), Ph.D., Research Assistant Professor of Cell Biology
 Hans J. Van Miegroet (1988), Ph.D., Assistant Professor of Art History
 Carel van Schaik (1989), Ph.D., Associate Professor of Biological Anthropology and Anatomy
 Stephanos Venakides (1986), Ph.D., Associate Professor of Mathematics
 John M. Vernon (1966), Ph.D., Professor of Economics
 P. Aarne Vesilind (1970), Ph.D., Professor of Civil and Environmental Engineering and Professor of Environmental Studies
 Dan O. Via, Jr. (1984), Ph.D., Professor of Religion, New Testament
 Steven Vigna (1987), Ph.D., Associate Professor of Cell Biology
 Teresa Maria Vilaros (1992), Ph.D., Assistant Professor of Romance Studies
 Rytas J. Vilgalys (1986), Ph.D., Assistant Professor of Botany

Elia E. Villanueva (1969), A.M., Associate Professor of Physical Therapy
 Lawrence Virgin (1989), Ph.D., Assistant Professor of Mechanical Engineering and Materials Science
 W. Kip Viscusi (1988), Ph.D., George G. Allen Professor of Economics
 S. Viswanathan (1986), Ph.D., Associate Professor of Business Administration
 Jeffrey Vitter (1993), Ph.D., Professor of Computer Science
 Steven Vogel (1966), Ph.D., Professor of Zoology
 Robin T. Vollmer (1975), M.D., Assistant Clinical Professor of Pathology
 Olaf T. von Ramm (1974), Ph.D., Professor of Biomedical Engineering
 Grant A. Wacker (1992), Ph.D., Associate Professor of Religion
 Robert A. Wagner (1978), Ph.D., Associate Professor of Computer Science
 Geoffrey Wainwright (1983), Dr.Theol., Professor of Religion, Systematic Theology
 Stephen A. Wainwright (1964), Ph.D., James B. Duke Professor of Zoology
 William D. Walker (1971), Ph.D., Professor of Physics
 T. Dudley Wallace (1974), Ph.D., James B. Duke Professor of Economics
 Wanda T. Wallace (1990), Ph.D., Assistant Professor of Business Administration
 Lise Wallach (1970), Ph.D., Research Professor of Psychology: Experimental
 Michael A. Wallach (1962-72; 1973), Ph.D., Research Professor of Psychology: Experimental
 Richard L. Walter (1962), Ph.D., Professor of Physics
 Paul P. Wang (1968), Ph.D., Professor of Electrical Engineering
 Calvin L. Ward (1952), Ph.D., Professor of Zoology
 Frances Ellen Ward (1969), Ph.D., Professor of Immunology
 Seth L. Warner (1955), Ph.D., Professor of Mathematics
 Robert E. Webster (1970), Ph.D., Professor of Biochemistry
 E. Roy Weintraub (1970), Ph.D., Professor of Economics
 Morris Weisfeld (1967), Ph.D., Professor of Mathematics
 Henry R. Weller (1978), Ph.D., Professor of Physics
 Richard L. Wells (1962), Ph.D., Professor of Chemistry
 Michael West (1990), Ph.D., Professor of Statistics
 Robert E. Whaley (1986), Ph.D., Professor of Business Administration and Associate Professor of Economics
 Annabel Wharton (1979), Ph.D., Associate Professor of Art
 Robin P. Wharton (1992), Ph.D., Assistant Professor of Microbiology
 Frances J. White (1987), Ph.D., Assistant Professor of Biological Anthropology and Anatomy
 Stephen William White (1990), Ph.D., Associate Professor of Microbiology
 Richard A. White (1963), Ph.D., Professor of Botany
 Richard Whorton (1979), Ph.D., Associate Professor of Pharmacology
 Karen E. Wigen (1990), Ph.D., Assistant Professor of History
 Carol J. Wikstrand (1975), Ph.D., Associate Medical Research Professor of Pathology
 Henry M. Wilbur (1973), Ph.D., Professor of Zoology
 Robert L. Wilbur (1957), Ph.D., Professor of Botany
 Hilda Pope Willett (1948), Ph.D., Professor of Microbiology
 Kenny J. Williams (1977), Ph.D., Professor of English
 Peter Fredric Williams (1985), Ph.D., Professor of Music
 Redford B. Williams (1991), M.D., Professor of Psychology: Social and Health Sciences
 Susan Willis (1989), Ph.D., Assistant Professor of English
 James F. Wilson (1967), Ph.D., Professor of Civil and Environmental Engineering
 John Wilson (1968), D.Phil., Professor of Sociology
 Thomas George Wilson (1959), Sc.D., Professor of Electrical Engineering
 Wilkie Andrew Wilson, Jr. (1974), Ph.D., Medical Research Professor of Pharmacology
 Robert G. Winfree (1974), M.A., Adjunct Associate Professor of Health Administration
 Robert L. Winkler (1984), Ph.D., Professor of Business Administration
 Orval S. Wintermute (1958), Ph.D., Professor of Religion
 Ronald G. Witt (1971), Ph.D., Professor of History
 Benjamin Wittels (1961), M.D., Professor of Pathology
 Myron L. Wolbarsht (1968), Ph.D., Professor of Ophthalmology in the Department of Psychology, Professor of Biomedical Engineering, and Associate Professor of Neurobiology
 Robert L. Wolpert (1984), Ph.D., Associate Professor of Statistics and Associate Professor of Environmental Studies
 Fulton Wong (1989), Ph.D., Associate Professor of Neurobiology
 Ronald C. Wong (1984), Ph.D., Assistant Professor of Electrical Engineering
 Peter H. Wood (1975), Ph.D., Professor of History
 Donald Wright (1967), Ph.D., Associate Professor of Mechanical Engineering and Materials Science
 Duncan Yaggy (1980), Ph.D., Professor of Public Policy Studies and Adjunct Associate Professor of Health Administration
 Jun Yang (1992), Ph.D., Assistant Professor of Mathematics
 Weitao Yang (1989), Ph.D., Assistant Professor of Chemistry
 William E. Yarger (1971), M.D., Assistant Professor of Cell Biology
 William P. Yohe (1958), Ph.D., Professor of Economics

Charles R. Young (1954), Ph.D., *Professor of History*
 John G. Younger (1974), Ph.D., *Professor of Classical Archaeology in Classical Studies*
 Michael Rod Zalutsky (1985) Ph.D., *Assistant Professor of Pathology*
 John W. Zarker (1989), Ph.D., *Senior Lecturing Fellow in Classical Studies*
 Fangyang Zheng (1990), Ph.D., *Assistant Professor of Mathematics*
 Peter Zwadyk, Jr. (1971), Ph.D., *Associate Professor of Pathology*

Professors Emeriti

Irving E. Alexander (1963), Ph.D., *Professor Emeritus of Psychology*
 Carl L. Anderson (1955), Ph.D., *Professor Emeritus of English*
 Lewis Edward Anderson (1936), Ph.D., *Professor Emeritus of Botany*
 Roger Fabian Anderson (1950), Ph.D., *Professor Emeritus of Entomology*
 Edward M. Arnett (1980), Ph.D., *R. J. Reynolds Professor Emeritus of Chemistry*
 Kurt W. Back (1959), Ph.D., *James B. Duke Professor Emeritus of Sociology*
 Joseph Randle Bailey (1946), Ph.D., *Professor Emeritus of Zoology*
 Frank Baker (1960), Ph.D., *Professor Emeritus of English Church History*
 M. Margaret Ball (1963), Ph.D., *Professor Emeritus of Political Science*
 Katharine May Banham (1946), Ph.D., *Associate Professor Emeritus of Psychology*
 William Waldo Beach (1946), Ph.D., *Professor Emeritus of Christian Ethics*
 Mary L. C. Bernheim (1930), Ph.D., *Professor Emeritus of Biochemistry*
 L. C. Biedenharn, Jr. (1961), Ph.D., *James B. Duke Professor Emeritus of Physics*
 William Dwight Billings (1952), Ph.D., *James B. Duke Professor Emeritus of Botany*
 Cazlyn Green Bookhout (1935), Ph.D., *Professor Emeritus of Zoology*
 Lloyd J. Borstelmann (1953), Ph.D., *Professor Emeritus of Psychology*
 Benjamin Boyce (1950), Ph.D., *James B. Duke Professor Emeritus of English*
 Charles Kilgo Bradsher (1939), Ph.D., *James B. Duke Professor Emeritus of Chemistry*
 Ralph Braibanti (1953), Ph.D., *James B. Duke Professor Emeritus of Political Science*
 Eleanor F. Branch (1953), Ph.D., *Associate Professor Emeritus of Physical Therapy*
 Martin Bronfenbrenner (1971), Ph.D., *William R. Kenan, Jr. Professor Emeritus of Economics*
 Earl Ivan Brown II (1960), Ph.D., *J. A. Jones Professor Emeritus of Civil Engineering*
 Louis J. Budd (1952), Ph.D., *James B. Duke Professor Emeritus of English*
 Frances Campbell Brown (1931), Ph.D., *Professor Emeritus of Chemistry*
 Edwin H. Cady (1973), Ph.D., *Andrew W. Mellon Professor Emeritus in the Humanities*
 Leonard Carlitz (1932), Ph.D., *James B. Duke Professor Emeritus of Mathematics*
 William H. Cartwright (1951), Ph.D., *Professor Emeritus of Education*
 Jack B. Chaddock (1966), Sc.D., *Professor Emeritus of Mechanical Engineering and Materials Science*
 Frederic N. Cleveland (1971), Ph.D., *Professor Emeritus of Political Science*
 Kalman J. Cohen (1974), Ph.D., *Distinguished Bank Research Professor Emeritus*
 Robert Taylor Cole (1935), Ph.D., *James B. Duke Research Professor Emeritus of Political Science*
 Joel Colton (1947), Ph.D., *Professor Emeritus of History*
 Robert Merle Colver (1953), Ed.D., *Associate Professor Emeritus of Education*
 Thomas Howard Cordle (1950), Ph.D., *Professor Emeritus of Romance Studies*
 Robert E. Cushman (1945), Ph.D., *Research Professor Emeritus of Systematic Theology*
 Bingham Dai (1943), Ph.D., *Professor Emeritus of Psychology*
 David G. Davies (1961), Ph.D., *Professor Emeritus of Economics*
 William D. Davies (1966), D.D., F.B.A., *George Washington Ivey Professor Emeritus of Advanced Studies and Research in Christian Origins*
 Eugene Davis Day (1962), Ph.D., *Professor Emeritus of Immunology*
 Irving T. Diamond (1958), Ph.D., *James B. Duke Professor Emeritus of Psychology*
 Neal Dow (1934), Ph.D., *Professor Emeritus of Romance Languages*
 Francis George Dressel (1929), Ph.D., *Professor Emeritus of Mathematics*
 Kenneth Lindsay Duke (1940), Ph.D., *Associate Professor Emeritus of Biological Anthropology and Anatomy*
 Howard Easley (1930), Ph.D., *Associate Professor Emeritus of Education*
 William Whitfield Elliott (1925), Ph.D., *Professor Emeritus of Mathematics*
 Ernest Elsevier (1950), M.S., *Associate Professor Emeritus of Mechanical Engineering*
 Henry A. Fairbank (1962), Ph.D., *Professor Emeritus of Physics*
 Arthur Bowles Ferguson (1939), Ph.D., *Professor Emeritus of History*
 Donald J. Fluke (1958), Ph.D., *Professor Emeritus of Zoology*
 Wallace Fowlie (1964), Ph.D., *James B. Duke Professor Emeritus of Romance Languages*
 John Hope Franklin (1981), Ph.D., *James B. Duke Professor Emeritus of History*
 Ernestine Friedl (1973), Ph.D., *James B. Duke Professor Emeritus of Anthropology*
 William J. Furbish (1954), M.S., *Associate Professor Emeritus of Geology*
 Thomas M. Gallie, Jr. (1954-55; 1956), Ph.D., *Professor Emeritus of Computer Science*
 W. Scott Gehman, Jr. (1954), Ph.D., *Professor Emeritus of Psychology in Education*
 Clarence Gohdes (1930), Ph.D., *James B. Duke Professor Emeritus of English*
 John R. Gregg (1957), Ph.D., *Professor Emeritus of Zoology*

Samson R. Gross (1960), Ph.D., *Professor Emeritus of Biochemistry*
 Kazimierz Grzybowski (1967), S.J.D., *Professor Emeritus of Political Science*
 Herbert Hacker, Jr. (1965), Ph.D., *Associate Professor Emeritus of Electrical Engineering*
 Hugh Marshall Hall, Jr. (1952), Ph.D., *Professor Emeritus of Political Science*
 John Hamilton Hollowell (1942), Ph.D., *James B. Duke Professor Emeritus of Political Science*
 Jerome S. Harris (1936), M.D., *Professor Emeritus of Biochemistry*
 William S. Heckscher (1966), Ph.D., *Benjamin N. Duke Professor Emeritus of Art*
 Henry Hellmers (1965), Ph.D., *Professor Emeritus of Botany and Professor Emeritus of Forestry*
 Stuart C. Henry (1959), Ph.D., *Professor Emeritus of American Christianity*
 Marcus Edwin Hobbs (1935), Ph.D., *University Distinguished Service Professor Emeritus of Chemistry*
 Irving B. Holley, Jr. (1947), Ph.D., *Professor Emeritus of History*
 Everett H. Hopkins (1961), M.A., LL.D., *Professor Emeritus of Education*
 Wanda S. Hunter (1947), Ph.D., *Associate Professor Emeritus of Zoology*
 Allan S. Hurlburt (1956), Ph.D., *Professor Emeritus of Education*
 B. Jon Jaeger (1972), Ph.D., *Professor Emeritus of Health Administration*
 Benjamin A. Jayne (1976), Ph.D., *Professor Emeritus of Forestry*
 Bronislas de Leval Jezierski (1958), Ph.D., *Associate Professor Emeritus of Slavic Languages and Literatures*
 Charles B. Johnson (1956), Ed.D., *Associate Professor Emeritus of Education*
 Terry W. Johnson, Jr. (1954), Ph.D., *Professor Emeritus of Botany*
 Brady Rimbey Jordan (1927), Ph.D., *Professor Emeritus of Romance Languages*
 Robert B. Kerr (1965), Ph.D., *Professor Emeritus of Electrical Engineering*
 Gregory A. Kimble (1952-68; 1977), Ph.D., *Professor Emeritus of Psychology*
 Paul Jackson Kramer (1931), Ph.D., *James B. Duke Professor Emeritus of Botany*
 Irwin Kremen (1963), Ph.D., *Assistant Professor Emeritus of Psychology*
 Juanita Kreps (1957), Ph.D., *James B. Duke Professor Emeritus of Economics*
 Wladyslaw W. Kulski (1963), Ph.D., LL.D., *James B. Duke Professor Emeritus of Russian Affairs*
 Weston LaBarre (1946), Ph.D., *James B. Duke Professor Emeritus of Anthropology*
 Leon Lack (1965), Ph.D., *Professor Emeritus of Pharmacology*
 Creighton Lacy (1953), Ph.D., *Professor Emeritus of World Christianity*
 Richard H. Leach (1955), Ph.D., *Professor Emeritus of Political Science*
 Harold Walter Lewis (1946), Ph.D., *University Distinguished Service Professor Emeritus of Physics*
 John L. Lievsay (1962), Ph.D., *James B. Duke Professor Emeritus of English*
 L. Sigfred Linderoth, Jr. (1965), M.E., *Professor Emeritus of Mechanical Engineering*
 Kenneth S. McCarty (1959), Ph.D., *Professor Emeritus of Biochemistry*
 John Nelson Macduff (1956), M.M.E., *Professor Emeritus of Mechanical Engineering*
 Sidney David Markman (1947), Ph.D., *Professor Emeritus of Art History and Professor Emeritus of Archaeology*
 Robert J. Melosh (1978), Ph.D., *Professor Emeritus of Civil and Environmental Engineering*
 Earl George Mueller (1945), Ph.D., *Professor Emeritus of Art*
 John W. Moore (1961), Ph.D., *Professor Emeritus of Neurobiology*
 Roland E. Murphy (1967-68; 1971), S.T.D., *George Washington Ivey Professor Emeritus of Old Testament*
 Francis Joseph Murray (1960), Ph.D., *Professor Emeritus of Mathematics*
 Aubrey Willard Naylor (1952), Ph.D., *James B. Duke Professor Emeritus of Botany*
 Yasuhiko Nozaki (1966), Ph.D., *Associate Professor Emeritus of Biochemistry*
 Holger O. Nygard (1968), Ph.D., *Professor Emeritus of English*
 James G. Osborne (1961), B.S., *Professor Emeritus of Forest Biometry*
 Suydam Osterhout (1959), M.D., Ph.D., *Professor Emeritus of Microbiology and Immunology*
 Harry Ashton Owen, Jr. (1951), Ph.D., *Professor Emeritus of Electrical Engineering*
 Erdman B. Palmore (1967), Ph.D., *Professor Emeritus of Sociology*
 Harold Talbot Parker (1939), Ph.D., *Professor Emeritus of History*
 William Bernard Peach (1951), Ph.D., *Professor Emeritus of Philosophy*
 Olan Lee Petty (1952), Ph.D., *Professor Emeritus of Education*
 Leland R. Phelps (1961), Ph.D., *Professor Emeritus of Germanic Languages and Literature*
 Jane Philpott (1951), Ph.D., *Professor Emeritus of Botany and Professor Emeritus of Wood Anatomy*
 Jacques C. Poinier (1955), Ph.D., *Professor Emeritus of Chemistry*
 William H. Poteat (1960), Ph.D., *Professor Emeritus of Religion*
 Jack J. Preiss (1959), Ph.D., *Professor Emeritus of Sociology*
 Richard A. Preston (1965), Ph.D., *William K. Boyd Professor Emeritus of History*
 James Ligon Price, Jr. (1952), Ph.D., *Professor Emeritus of Religion*
 Louis DuBose Quin (1957), Ph.D., *James B. Duke Professor Emeritus of Chemistry*
 Jacqueline A. Reynolds (1969), Ph.D., *Professor Emeritus of Cell Biology*
 Lawrence Richardson, Jr. (1966), Ph.D., *James B. Duke Professor Emeritus of Classical Studies*
 J. David Robertson (1966), M.D., Ph.D., *James B. Duke Professor Emeritus of Neurobiology*
 Theodore Ropp (1938), Ph.D., *Professor Emeritus of History*
 Mabel F. Rudisill (1948), Ph.D., *Associate Professor Emeritus of Education*
 Charles Richard Sanders (1937), Ph.D., *Professor Emeritus of English*
 Lloyd Saville (1946), Ph.D., *Professor Emeritus of Economics*

Harold Schiffman (1963), Ph.D., *Professor Emeritus of Psychology*
 Knut Schmidt-Nielsen (1952), D.Ph., *James B. Duke Professor Emeritus of Physiology and Zoology*
 Anne Firor Scott (1961), Ph.D., *William K. Boyd Professor Emeritus of History*
 Joseph R. Shoenfield (1952), Ph.D., *Professor Emeritus of Mathematics*
 William H. Simpson (1930), Ph.D., *Professor Emeritus of Political Science*
 Donald S. Smith II (1961), M.H.A., *Assistant Professor Emeritus of Health Administration*
 John R. Spencer (1978), Ph.D., *Professor Emeritus of Art History*
 William Franklin Stinespring (1936), Ph.D., *Professor Emeritus of Old Testament and Semitics*
 Howard Austin Strobel (1948), Ph.D., *Professor Emeritus of Chemistry*
 W. A. Stumpf (1948), Ph.D., *Professor Emeritus of Education*
 Elizabeth Read Sunderland (1939-42; 1943), Ph.D., *Professor Emeritus of Art*
 Charles Tanford (1960), Ph.D., *James B. Duke Professor Emeritus of Physiology*
 James Nardin Truesdale (1930), Ph.D., *Professor Emeritus of Greek*
 Richard L. Tuthill (1953), Ed.D., *Professor Emeritus of Economic Geography*
 Patrick R. Vincent (1954), Ph.D., *Associate Professor Emeritus of Romance Languages*
 F. Stephen Vogel (1961), M.D., *Professor Emeritus of Pathology*
 Bruce W. Wardropper (1962), Ph.D., *William Haynes Wannamaker Professor Emeritus of Romance Studies*
 Richard Lyness Watson, Jr. (1939), Ph.D., *Professor Emeritus of History*
 Henry Weitz (1950), Ed.D., *Professor Emeritus of Education*
 Paul Welsh (1948), Ph.D., *Professor Emeritus of Philosophy*
 Robert W. Wheat (1958), Ph.D., *Professor Emeritus of Microbiology*
 Karl Milton Wilbur (1946), Ph.D., *James B. Duke Professor Emeritus of Zoology*
 Pelham Wilder, Jr. (1949), Ph.D., *University Distinguished Professor Emeritus of Chemistry*
 George W. Williams (1957), Ph.D., *Professor Emeritus of English*
 William Hailey Willis (1963), Ph.D., *Professor Emeritus of Greek in Classical Studies*
 Cliff W. Wing, Jr. (1965), Ph.D., *Professor Emeritus of Psychology*
 Max A. Woodbury (1966), Ph.D., *Professor Emeritus of Computer Science*
 James G. Yoho (1984), Ph.D., *Professor Emeritus of Forestry*
 Franklin W. Young (1944-50; 1968), Ph.D., *Amos Ragan Kearns Professor Emeritus of New Testament and Patristic Studies*

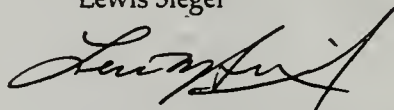
TO THE PROSPECTIVE GRADUATE STUDENT

A graduate school is where excellence in scholarship is established in a university. At Duke, the Graduate School is where the two essential functions of a university, teaching and research, truly come together. Over the years Duke's strength at the graduate level has grown in all the main fields of knowledge. The 1980s were particularly fruitful years for recruitment of faculty, establishment of new programs, and attraction of outstanding students. The international distinction of the faculty continues to grow in the 1990s. The laboratories, libraries, and computer facilities, already among the very best, are targets of major enhancements in the next decade. Yet the Graduate School remains small enough so that personal contact is a central feature of our programs, and fruitful interaction across disciplines is a common experience, both for faculty and students.

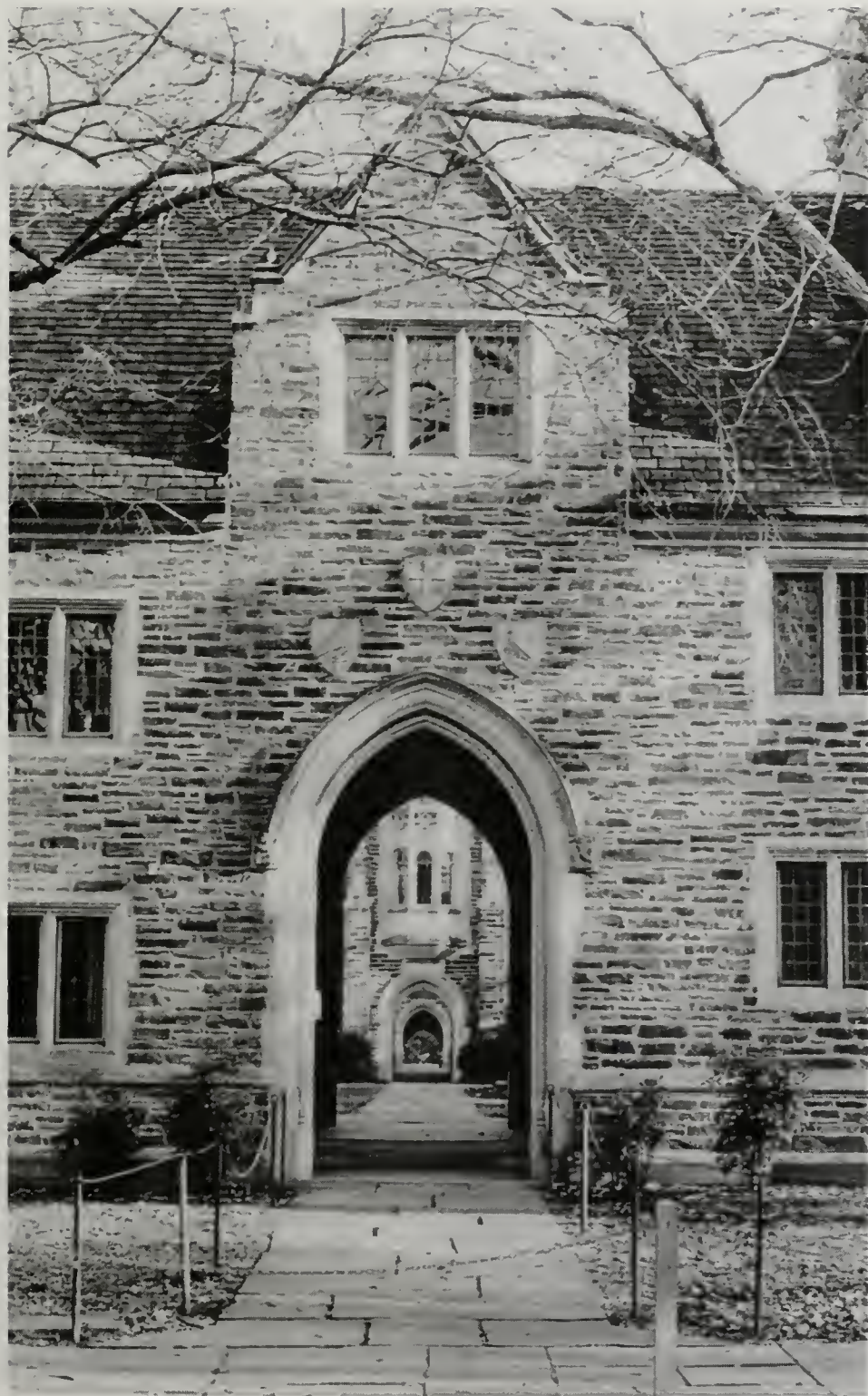
For the student in search of a strong graduate education, Duke University has much to offer. This is a community in which minds and ideas grow. We provide training for many careers, but we seek also to foster personal creativity and to provide stimulating yet congenial surroundings for productive education and research.

The following pages provide the information you require in making the important choice of the course of your graduate education. We look forward to welcoming you to the Duke community of scholars.

Lewis Siegel

A handwritten signature in dark ink, appearing to read 'Lewis Siegel', with a stylized, flowing script.

Dean of the Graduate School



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Admission



Degree and Nondegree Admission

Students who wish to undertake graduate work at Duke University, whether for degree or nondegree purposes, must be formally admitted to the Graduate School by the dean. Prerequisites for admission include a bachelor's degree (or the equivalent) from an accredited institution and, for degree programs, satisfactory scores on the Graduate Record Examination. Individual departments may specify additional prerequisites, which can be found in the chapter on "Courses of Instruction."

Students who do not intend to earn an advanced degree at Duke, but who wish to take graduate courses, may apply for nondegree admission. Such admission is granted in three different categories: (1) admission as a regular nondegree student with a particular department; (2) admission as a special nondegree student without departmental affiliation through the Office of Continuing Education; and (3) admission as an unclassified student in the summer session only.

Credits earned by nondegree students in graduate courses taken at Duke before full admission to the Graduate School may be carried over into a graduate degree program if (1) the action is recommended by the student's director of graduate studies and approved by the dean, (2) the work is not more than two years old, (3) the amount of such credit does not exceed 12 units, and (4) the work has received grades of *G* or better.

Students who have discontinued a program of degree work at Duke must apply for readmission to the Graduate School. Those who discontinue study *prior* to completing a degree must, by letter, request permission of the dean to be readmitted to the degree program; those who discontinue study *after* earning a master's degree must file a new application for the doctoral program.

Admission Procedures*

A student seeking admission to the Graduate School should obtain an application bulletin from the Graduate School Admissions Office. This packet contains the necessary forms and detailed instructions on how to apply. All parts of the application form must be filled out completely, signed, and returned to the Graduate School Admissions Office accompanied by the necessary supporting documents and a nonrefundable application fee. This fee is \$65† in U.S. currency (check or money order payable to Duke University through a U.S. bank). However, if the application is received by December 1, the fee is

*This chapter is a brief summary of, and supplement to, information contained in the current Graduate School application bulletin, which should be consulted for more comprehensive information on all aspects of the process of applying for admission and award.

†All fees are based on current charges and are subject to change without notice.



reduced to \$50. The required supporting documents are: (1) one copy of an official, *confidential* transcript from each postsecondary institution attended, sealed in a *confidential* envelope and signed-across-the-seal by the registrar at the institution; (2) three letters of evaluation, written on the forms provided and returned by the applicant in the confidential envelopes that have been sealed-then-signed by the evaluators; (3) official scores on the Graduate Record Examination General Test for applicants to all departments; and (4) official scores on the Graduate Record Examination Subject Test for applicants to certain specified departments. Please consult the current application bulletin for more detailed information on all requirements.

Applications cannot be reviewed until all supporting documents are on file. *Materials submitted in support of an application are not released for other purposes and cannot be returned to the applicant.*

Students applying for fall admission and award should take the Graduate Record Examination no later than the October testing in the previous year in order to meet our deadlines. Information on the times and places of the Graduate Record Examinations can be obtained from the applicant's college or the Educational Testing Service, P.O. Box 6000, Princeton, New Jersey 08541-6000.

Additional Procedures for Foreign Students. Fully qualified students from outside the United States are invited to apply for admission to full-time study in the Graduate School. The foreign student must, in addition to the information required of all students, submit with the application materials: (1) if the student's native language is not English, certification of English proficiency demonstrated by official scores from the Test of English as a Foreign Language (TOEFL), administered through the Educational Testing Service, P.O. Box 6155, Princeton, New Jersey, 08541-6155 (the Graduate School requires a minimum score of 550); and (2) a statement showing financial arrangements for the proposed term at Duke (estimated costs per calendar year are about \$27,000).*

During new matriculants' first registration period at Duke, every foreign student whose native language is not English will be required to take a test to verify competence in the use of oral and written English. Students found to lack necessary competence will be expected to undertake additional English language instruction. Students who do not perform satisfactorily on the competency test by the end of their first year of residency will not be permitted to continue graduate work at Duke University. Please note that the competency test does not take the place of the TOEFL 550 requirement, nor does passing the competency examination meet degree requirements for a foreign language.

Part-Time Graduate Study. Many graduate departments will consider applications from students wishing to pursue degree study on a full-time or part-time basis. (Consult application materials for listing of departments.) Admission requirements, procedures, and deadlines are the same in either case. See the chapter on "Registration" for additional rules governing minimum registration, time limitations, and financial aid restrictions on part-time study. *Visa restrictions do not allow nonimmigrant students to pursue graduate study on a part-time basis.*

Master of Arts in Liberal Studies Procedures. Students seeking admission to the MALS should contact that program directly for information, requirements, and special application materials.

Summer Session Procedures. Students who wish to begin graduate work during the summer must check first with the department of interest concerning available courses or research work, as well as funding possibilities; some departments have

*Figures are based on 1992-93 charges and are subject to change without notice.

summer offerings and others do not. Applications should be submitted according to the fall deadline schedule, since summer files will be reviewed along with others who plan to begin in late August.

In addition to the application for regular admission to the Graduate School, students must also apply directly to the summer session. Application forms and catalogues may be obtained from Summer Session, the Bishop's House, Duke University, Durham, North Carolina 27708, telephone (919) 684-2621.

Students who wish to take graduate courses in the summer but not pursue a graduate degree may be admitted to the summer session under the following categories. *Duke Students:* current students in good standing may attend the summer session without formal application. *Non-Duke Students:* other persons may seek admission to the summer session provided they are (or were) in good standing at a fully accredited college or university.

Continuing Education Procedures. A student seeking admission as a nondegree continuing education graduate student at Duke must have received a bachelor's degree and must either reside in the area or be moving to the area with the intention of residing here for a substantial period of time. Application materials and additional information may be obtained from the Office of Continuing Education, The Bishop's House, Duke University, Durham, North Carolina 27708, telephone (919) 684-6259.

Review of Application and Notification of Status. All applications are considered without regard to race, color, religion, national origin, handicap, veteran status, sexual orientation or preference, sex, or age.

Application files are assembled in the Graduate School Admissions Office, where all official record-keeping is maintained. Applications, when complete, are sent to the departments. A departmental admissions committee, usually headed by the director of graduate studies, reviews the applications and makes recommendations to the dean. Formal admission to the Graduate School is offered only by the dean, who will send the official letter of admission and an acceptance form. The process of admission is not complete until the student returns the acceptance form. *Admission may not be deferred from one term to another; an admission offer is only for the semester specified in the letter of admission.*

Immunizations. North Carolina Statute G.S.: 130A-155.1 states that no person shall attend a college or university, public, private, or religious, excluding students attending night classes only and students matriculating in off-campus courses, unless a certificate of immunizations against diphtheria, tetanus, whooping cough, poliomyelitis, red measles (rubeola), and rubella is presented to the college or university on or before the first day of matriculation. The required forms and instructions are provided to students in the packet of materials sent with the letter of admission.

Deadlines for Application

It is the applicant's responsibility to make certain that the Graduate School Admissions Office has received all required materials by the appropriate deadlines. Only complete applications can be considered. To ensure that the admissions office will have adequate time to assemble all items submitted on an applicant's behalf, applications should be sent *at least* two weeks before the stated deadlines.

Consult current application materials for a more detailed explanation of deadlines and their enforcement.

FOR FALL SEMESTER

December 1. Deadline for receipt of applications eligible to pay the reduced application fee of \$50. All applications postmarked after this date must be accompanied by a fee of \$65 or they will not be processed.

December 31. Deadline for postmark of applications for admission and award to all programs for the fall 1994 semester. (Note: Applications must arrive in the Graduate School within fourteen days of the December 31 postmark date.)

December 31 is the **Priority Filing Date**. Applications postmarked *and* completed by this date are guaranteed a review; those postmarked/completed after this date are not guaranteed consideration. Late applications may be considered for admission, only if all spaces have not been filled, and for financial aid, only if funds are still available.

All students seeking fall admission should complete their applications by the Priority Filing Date, since it is likely that enrollment in many departments will be filled soon after this date. Applications which are incomplete on December 31 cannot be considered for awards until decisions have been made on all complete applications.

The final cut-off date for processing new applications is July 15. Few departments, however, continue to review applications this late. No applications for fall received after this date will be processed.

FOR SPRING SEMESTER

November 1. Final date for completion of applications for admission to the spring semester, space permitting. Not all departments accept new students for the spring semester, nor is financial aid readily available for spring matriculants.

FOR SUMMER SESSION

Students seeking admission to the Graduate School for study in the summer session should apply for Graduate School admission according to the fall deadline schedule and for summer session admission according to the following schedule:

April 15. Last day for completing summer session application to Term I.

May 15. Last day for completing summer session application to Term II.

Financial Information



Tuition and Fees*

STUDENTS ENROLLING FALL SEMESTER 1992

The 1993-94 tuition for new students enrolling full-time during the fall semester (except those students in physical therapy) is \$5,100 (12 units at \$425 per unit) or \$3,825 (9 units at \$425 per unit) for teaching and research assistants. In addition to tuition a registration fee of \$700 (not applicable for students who matriculated before fall semester 1985) is required each semester. Part-time tuition is calculated at the rate of \$425 per unit in the fall, spring, and summer.

Payment of Accounts. Duke University does not have a deferred payment plan for tuition, fees, or other charges. New students are expected to pay tuition and fees at the time of matriculation. Following first enrollment in the Graduate School, monthly invoices are sent to each student by the bursar's office. As a part of the agreement of admission to Duke University a student is required to pay all invoices upon receipt.

Graduate students who receive payments from the university for fellowships, assistantships, or employment and who plan to pay tuition and fees and/or campus housing charges via payroll deduction must make arrangements for payroll deduction in the bursar's office by the published deadline for each semester in order to avoid assessment of the late payment charge.

All full-time graduate students and part-time degree candidates are charged the student health fee as well as student accident and sickness insurance coverage unless they file properly completed and signed insurance waivers in the bursar's office by the invoice date. Students registered *in absentia* are not charged the health fee and insurance unless they elect to enroll in the insurance plan. The student accident and sickness insurance payment is due in full at the beginning of the term. Payment in full for campus housing is due at the beginning of each semester unless the student qualifies for university payroll deduction.

Late Payment Charge. A late registration fee of \$25 is charged any student who does not complete registration during the announced registration periods. Also, students

*All fees are based on current charges and are subject to change without notice.

who fail to pay by the due date the total amount of an invoice received from the bursar will be charged a late payment fee. That fee is assessed at the rate of 1 1/4 percent per month applied to the past due balance and accrued from the billing date of the invoice (matriculation date for new students).

Restrictions. A student in default on tuition or fee charges will not be allowed to register for classes, receive a transcript of academic records, have academic credits certified, be granted a leave of absence, or receive a diploma at graduation. In addition, such students may be subject to withdrawal from the Graduate School.

Reduction in Registration and Tuition. Full refunds are granted students who reduce registration on the drop/add date at the beginning of each semester. A reduction in registration and tuition necessitated by changes in departmental service requirements for assistants may be made during the first week of classes with approval of the dean.

Refunds for Withdrawal from School during Fall and Spring Semesters. For students who withdraw from school or who are withdrawn by the university, refunds of tuition and fees are governed by the following policy.

1. In the event of death, refund of full tuition and fees will be granted.
2. In all other cases of withdrawal from the university, students may have tuition refunded according to the following schedule:
 - a. Withdrawal before classes begin: full refund;
 - b. Withdrawal during the first or second week of classes: 80 percent refund (the student health fee will not be refunded);
 - c. Withdrawal during the third, fourth, or fifth week of classes: 60 percent refund (the student health fee will not be refunded);
 - d. Withdrawal during the sixth week: 20 percent refund (the student health fee will not be refunded);
 - e. Withdrawal after the sixth week: no refund.
 - f. Tuition charges paid from grants or loans will be restored to those funds on the same pro rata basis and will not be refunded or carried forward.
3. If a student has to drop a course for which no alternate registration is available, drops special fee courses (music, golf, etc.), or drops a paid audit during the first two weeks of the drop/add period, a full refund may be granted with the approval of the dean. (The student health fee will not be refunded.)

Withdrawal Charges and Refunds during Summer Session. Students who will not be attending a summer term or course(s) for which they have registered must follow the correct procedure and drop the course(s) prior to the first day of the term, even if they have not paid tuition and fees. Failure to drop the course(s) will result in administrative withdrawal from the summer session at the end of the first three days of the term and in billing the student for 20 percent of the tuition plus the health fee. If tuition and fees have been paid for the summer term, the following refund policies apply:

1. When applications for withdrawal from a term or drop of a course are received by the director of the Summer Session before the first class day of a given term, full tuition and fees will be refunded.
2. When applications for withdrawal are received by the director during the first three class days, 80 percent of the tuition will be refunded. (The health fee will not be refunded.)
3. When applications for withdrawal from a term or drop of a course are received by the director after the third class day, there will be no refund of tuition and fees.

Special Tuition Benefits for Employees. The Graduate School recognizes a special obligation to encourage the professional and personal advancement of employees. The

university thus grants reductions in tuition to eligible employees enrolling in courses offered by the university.

Half-time employees with one or more years of continuous service who receive permission of their supervisors may take up to two courses a semester and will be charged one-half of the tuition rate. This benefit applies *only* to nondegree work. Full-time employees (30 or more hours a week) with two or more years of continuous service who receive permission to take such courses will be charged one-tenth the tuition rate for up to two courses per semester and will be permitted to audit at no charge. This benefit applies to degree work as well as nondegree. Tuition reduction for undergraduate or graduate course work is considered taxable income under current law.

Employees who wish to take graduate classes on a nondegree basis apply through Continuing Education. No Graduate Record Exam is required at this point. If an employee is later admitted into a degree program, up to 12 semester hours of these credits may then be transferred into that program if certain criteria are met (see page 55).

Employees wishing to enroll in a graduate degree program may apply directly to the Graduate School. Since not all of these programs can accommodate part-time study, please make early contact with the appropriate department for advice on your particular educational needs.

Eligible employees should consult the Benefits Office, 705 Broad Street, (919) 684-6723, at least three weeks in advance of payment date to obtain the appropriate tuition voucher.

Thesis or Dissertation Fees. Fees incurred in connection with a thesis or dissertation are as follows:

Binding fee, three university copies of thesis or dissertation	\$25
Microfilming fee, doctoral degree only, upon final submission	\$45
Copyright fee (doctoral degree only, optional)	\$25

Athletic Fee. An athletic fee of \$125 for basketball games is *optional* and payable early in the fall semester.

Fee for Undergraduate Courses. Graduate students registering for undergraduate courses will be assessed 3 units for a nonlaboratory course and 4 units for a laboratory course.

Marine Laboratory Fee. For Marine Laboratory investigators' research table fee, see the publication *Marine Laboratory 1993*.

Audit Fee. Auditors are permitted on a space available basis with the consent of the instructor. Students registered full time during fall and spring may audit courses without charge. Audit fees are \$160 per course.

During the summer, students registered for a full course program (two courses) may audit nonlaboratory courses (except physical education activity courses, applied music courses, and studio art courses) with the permission of the instructor and the director of the Summer Session at no extra charge. Students carrying less than a full course program during the summer may be granted permission by the instructor and the director to audit a course (above restrictions apply), but must pay half the university tuition charge for the course.

Vehicle Fee. Resident students are required to pay an annual fee of \$135 for gated lots, \$55 for ungated lots, or \$30 for each two-wheeled motor vehicle. Resident students registering a vehicle for the first time after January 1 are required to pay \$37 for a motor vehicle or \$19 for a two-wheeled motor vehicle.

If a motor vehicle or a two-wheeled vehicle is removed from the campus permanently and the permit is returned to the traffic office prior to January 20, there will be a

refund of \$25 for a motor vehicle and \$12.50 for a two-wheeled motor vehicle. Gated lot permits are prorated accordingly.

Students enrolled in the summer session only must also register their motor vehicles with the traffic office. The fee is \$17.50 from May 1 through August 31, or \$7 for each thirty-day period.

Transcript Fee. Students who wish to obtain copies of their academic records should direct requests to the registrar's office. A fee of \$2 is charged for each copy.

The Student Health Fee. All full-time students and part-time degree candidates (except those registered *in absentia*) are assessed a fee for the Student Health Service. For the fall and spring, the fee is \$350 (\$175 each semester). For the summer, the fee is \$115. The health fee will be \$34 for each five-week period at the Marine Laboratory.

Expenses*

The table below represents an estimate of a graduate student's basic expenses during the fall and spring for a full program of work. Miscellaneous items (recreation, travel, clothing, laundry, etc.) will vary according to personal needs and tastes. Student insurance is available through Duke for students not covered under another policy. The *estimated* rate for 1993-94 is \$650. Students are billed for insurance and must waive the charge if they are covered under another policy. See the chapter "Student Life" for more information on student health insurance.

Tuition (24 units)	\$10,200
Registration fee	1,450
Student health fee	350
Student activity fee	10
Apartment rent	3,320
Meals	2,931
Books and supplies	486
Miscellaneous	<u>2,896</u>
Total	\$21,953

The estimated cost for two sessions summer registration is:

Registration Fee	700
Student health fee	115
Apartment Rent	1107
Meals	978
Miscellaneous	<u>966</u>
Total	\$3,916

Fellowships and Scholarships

Application Procedure. Fellowships and scholarships are available to students in most graduate programs. A student who wishes to be considered for any of the following

*The figures contained in this section are based on 1992 figures and are subject to change prior to the beginning of the fall 1993 semester.

fellowships, scholarships, or assistantships should so indicate on the application form for admission and award. Selection of award recipients is made on the basis of academic merit and departmental recommendations.

While personal financial need may not be the basis for the granting of many graduate awards, the Graduate School requests that all matriculating students (except non-United States citizens) complete the Graduate and Professional Student Financial Aid Service (GAPSFAS) form.

Satisfactory Progress. A graduate student is expected to make satisfactory progress in his or her program in order to remain enrolled in a degree program or to receive financial aid. (See the section on grades in the chapter "Regulations.") A student is considered to be making satisfactory progress if he or she is eligible to continue during the academic year. Determination of academic load is made at the end of the drop/add period for each semester. If hours are reduced below these levels, the Graduate School Financial Aid Office must be notified and some monies or types of aid may have to be repaid. The student should contact the financial aid office if this situation is contemplated or occurs.

Departmental Fellowships. Various departments and schools within Duke University have fellowships which are available to students pursuing graduate study. Information may be obtained from the individual departments.

Graduate Scholarships. Graduate scholarships funded by Duke University are available to students in many departments of the Graduate School for study during the academic year. Awards are for full or partial payment of tuition; they range in value to \$11,439 for fall, spring, and summer.

ENDOWED FELLOWSHIPS

James B. Duke Fellowships. The James B. Duke One-Hundredth Anniversary Fund provides fellowships for students who wish to pursue a program leading to the Ph.D. degree in the Graduate School at Duke University. Its objective is to aid in attracting and developing outstanding scholars at Duke. Selection of recipients is made by a faculty committee upon nomination by the appropriate department. These fellowships provide a \$3,000 stipend supplement for four years to any other award the student receives from the department, the Graduate school, or national fellowships. In addition, the student will receive a cost of relocation allowance of \$1,000 upon matriculation.

International Fellowships are available to outstanding students from foreign countries who have completed their undergraduate education in institutions outside the United States. Fellowships provide an annual stipend of \$10,000, payable for twelve months, plus tuition and health fees. They are renewable for three years. Recipients are chosen competitively from departmental nominees by a faculty committee.

Special fellowships are also available for students concentrating in *Latin American Studies*.

Other special endowments provide fellowships for graduate study. The Julian Price Fellowship is offered to outstanding students in the humanities. The Ray Tysor Fellowship is available to students in the biological sciences. The Gurney Harris Kearns Fellowship is offered to students in religion. The E. Bayard Halsted Fellowship in science, history, or journalism is awarded to a graduate of Duke University intending to pursue an advanced degree at Duke. The Frank T. de Vyver Fellowship, administered by the Department of Economics, is awarded each year to an outstanding student entering the doctoral program in economics. The Clare Hamilton Memorial Endowed Fellowship is awarded yearly on the basis of merit and need to one or more outstanding students in clinical psychology. The Charles R. Hauser Fellowship is awarded to an outstanding graduate student in the last year of work toward a Ph.D. degree in organic chemistry. The Calvin Bryce Hoover Fellowship is administered by the Department of

Economics and is awarded each year to an outstanding student entering the doctoral program in economics. The Robert R. Wilson Fellowship in the Department of Political Science is awarded to a student currently enrolled in or entering a doctoral program in international law, international organization, or international relations. The Gertrude Weil Fellowship, administered by the Department of Religion, is awarded to students interested in Judaic studies. The John L. Lievsay Fellowship is awarded to a dissertation-year student in English literature. The Anne McDougall Memorial Award for Women, administered through women's studies, is awarded each year to one woman student studying psychology or a related field. Selection for these fellowships is made through faculty committees.

FEDERAL FELLOWSHIPS.*

Duke University participates in the following programs:

National Science Foundation Fellowships. A number of students hold National Science Foundation Graduate Fellowships which provide tuition plus a stipend of \$12,300.

Jacob K. Javits Fellows Program. This federal program for students in the humanities provides tuition plus a stipend of up to \$10,000 based on the student's need.

Other federal programs support fellowships, traineeships, and research assistantships through departmental auspices.

SPECIAL FELLOWSHIPS.

The following special fellowships are available to qualified Duke students from sources outside the university:

Shell Fellowships are available to students in the social sciences engaged in dissertation research on developing countries. Recipients must be citizens of the United States or permanent residents intending to become United States citizens. The fellowships are designed to cover the expenses of field research in the preparation of doctoral dissertations. The stipend for each fellowship is \$7,000 plus a reasonable amount for transportation expenses. Recipients are chosen competitively from departmental nominees. Inquiries should be made to the Program Coordinator, Center for International Studies, 2122 Campus Drive, Durham, North Carolina 27706.

Frederick K. Weyerhaeuser Forest History Fellowship. This fellowship is available campus-wide to students who wish to study broadly in the area of forest and conservation history. The annual stipend is \$10,000. Inquiries should be made to the Forest History Society, 701 Vickers Avenue, Durham, North Carolina 27701.

GRADUATE FELLOWSHIPS FOR MINORITY STUDENTS.

A substantial pool of fellowship funds is reserved for the support of minority students, in some instances with a multiyear commitment.

Duke Endowment Fellowships. The university has allocated substantial funds exclusively for the support of U.S. minority students. These awards, called The Duke Endowment fellowships, are made to students who have been nominated by their departments to a central review committee, which considers all nominations and announces the recipients. The fellowships cover tuition and fees as well as provide a stipend up to \$10,800 for a twelve-month period. These fellowships are awarded for up to four years if the student has a master's and three years if the student has the baccalaureate degree.

Presidential Fellowships. The Presidential Fellowships represent one of Duke's newest initiatives in providing financial support for minority students. The fellowship

*United States citizenship is generally a requirement for eligibility.

covers tuition, and provides a stipend of \$11,000 and a \$500 book award for a twelve-month period. These fellowships are awarded for two years if the student has a master's and for three years if the student has a baccalaureate degree.

Patricia Roberts Harris Fellowship Program. This program makes direct fellowship grants available to colleges and universities for the purpose of providing financial support to minority and women graduate and professional students who demonstrate financial need. Duke has received fellowship support through this program and will continue to apply for this support for our graduate departments. The fellowships are funded by the Department of Education and are awarded for up to three years of graduate study.

The National Consortium for Educational Access (NCEA) Fellowship. The NCEA is a partnership agreement between historically black colleges and universities, Ph.D.-degree granting institutions, and corporations. The goals of the NCEA are (1) to increase the pool of black Americans holding the Ph.D. degree in disciplines where they are now underrepresented; and (2) to address the underrepresentation of black faculty in the nation's colleges and universities. The NCEA provides fellowship support for both students and faculty enrolled in a member Ph.D.-granting institution. Students are eligible to receive a minimum of \$3,000 per year, while faculty are eligible for a minimum of \$5,000 per year in assistance. These fellowships are in addition to financial assistance the Ph.D. candidates receive from the participating institution. Students can apply for this fellowship directly through the NCEA by obtaining an application from a member institution or by writing to: Dr. Leroy Ervin, Executive Director, National Consortium for Educational Access, 296 Interstate North Parkway, Suite 100, Atlanta, GA 30339.

FELLOWSHIPS FOR ADVANCED GRADUATE STUDENTS:

Andrew W. Mellon Graduate Fellowships in the Humanities. As many as three one-year dissertation fellowships are awarded to advanced graduate students in the humanities. Selection of recipients is made by a faculty committee upon recommendation by the appropriate department. These fellowships provide for payment of tuition and health fees plus a monthly stipend.

Alaine Webb Dissertation Research Fellowship provides support for miscellaneous research projects associated with the dissertation.

Dissertation Travel Awards are provided for overseas research travel.

Conference Travel Awards fund advanced students who are presenting papers at national conferences.

Named Instructorships in Arts and Sciences. Five of these awards are provided jointly by the Graduate School and Trinity College. The student is required to teach one course during the academic year in which they hold the award.

Alison Bracy von Brock Talent Identification Program Research Fellowship Fund. This fund will support research in the area of the academically talented, curriculum design and/or teaching methods of the Talent Identification Program. First priority will be given to a Duke University doctoral candidate for postpreliminary examination dissertation research. Second priority shall be given to a qualified postdoctoral candidate to conduct research at Duke University as a visiting fellow under the auspices of the Talent Identification Program. The award will be made for one year with a possible renewal for a second year.

Exchange Fellowships with the Free University of Berlin are available through an exchange arrangement with the Free University of Berlin which will provide funds for one graduate student to study during the regular academic year in Berlin.

Assistantships

Graduate Assistantships. Appointments as graduate assistants carry a total stipend of up to \$13,500 for the academic year. The value of the stipend is determined by the time spent in assisting, the qualifications of the assistant, and the nature of the work

assigned. Graduate assistants also may receive tuition scholarships in addition to payments for service as an assistant.

Research Assistantships. Appointments are available for graduate students whose special training and qualifications enable them to serve as assistants to individual staff members in certain departments. Stipends may be up to \$13,500 depending on the nature of the assistance and the assisting time required.

Part-time Instruction. Several departments offering graduate work have exceptionally qualified graduate students work as part-time instructors, tutors, and teaching assistants. Amounts of these assistantships vary and interested applicants should contact their departments directly.

Payment of Awards

The payment of stipends for graduate assistantships and fellowships starts on September 25 and is made in equal payments on the twenty-fifth day of each month thereafter. Fellowship stipends are paid on the last working day of the month, beginning in September. Under the Tax Reform Act of 1986, the only graduate student financial assistance exempt from taxation are amounts paid for tuition, fees, books, supplies, and equipment required for course instruction. If services are required for payment of tuition and fees, then that tuition is considered income and is subject to taxation. The Graduate School office will supply detailed information.

It is the responsibility of the student to be sure that tuition and fees are paid or that arrangements have been made with the appropriate office or department for submission of tuition payment notices to the bursar (101 Allen Building). Graduate students should contact either the director of graduate studies in their department or the Graduate School financial aid coordinator (120 Allen Building) depending upon the type of award. Faculty, senior administrative staff, employees, and eligible spouses not in degree programs should contact Harrison Brooke (705 Broad Street) regarding tuition benefits.

Loans

Students who anticipate a need to supplement their financial resources through loans or college work-study employment must obtain and complete Free Application for Federal Student Aid. These forms are available at most financial aid offices or from the Financial Aid Coordinator, Graduate School, Duke University, Durham, North Carolina 27706. A student seeking a loan should contact his or her state lending agency, request an application from the Financial Aid Office.

Only students with full-time status who are U.S. citizens at permanent residents and who meet the federal criteria for need are eligible for loans. Loan funds are provided through the Carl Perkins Student Loan Program after a student has borrowed the maximum from the Federal Stafford Loan Program. Generally, loans made from these funds, as is the case with loans from state agencies, bear no interest charge to qualified borrowers while they maintain student status and for a short period thereafter. Interest during the repayment period is at a favorable rate.

Inquiries concerning loans should indicate the department of intended matriculation and include all pertinent information concerning application to a state agency. These inquiries should be addressed to the Financial Aid Coordinator, Graduate School, Duke University, Durham, North Carolina 27706.

Work-Study Program Employment

Funds are available through the college work-study program for short-term or part-time employment of graduate students. A student who wishes to apply for work-study must complete a Free Federal Financial Aid form. Students considering the possibility of work-study for the fall should submit Free Federal Financial Aid forms by

April 15. Eligibility requirements are similar to those of the federal loan programs. In addition to departmental employment opportunities, the placement office maintains a listing of employment openings for students.

Summer Financial Aid

A limited amount of financial aid is available to students in summer study. Summer financial aid, determined according to demonstrated need, may consist of institutional grant funds and/or low interest loans from the Stafford Student Loan program and the Carl Perkins Student Loan program. To qualify for summer school aid, a student must be enrolled or accepted for enrollment at Duke during the academic year immediately preceding the summer for which aid is requested. (Students must be registered for summer school in order to receive summer support. Students enrolled only for the summer may be eligible to borrow from outside lenders under the Stafford program in their home states or from the schools at which they are regularly enrolled. They should contact their college's financial aid office or the state's department of higher education for information and applications.) The college work-study aid is determined by the financial aid office based upon the student's financial need and the availability of funds. Graduate awards are determined by departments depending on usual criteria and availability of funds.

Registration



Registration

All students must register each fall and spring semester for credit toward their degrees and pay a registration fee each semester unless waived by an approved leave of absence granted by the dean. Doctoral students must register for a minimum of 60 units of degree credit. After the 60 units of credit have been achieved, the student will pay only the registration fee each semester until all degree requirements have been met. A master's student (except for those students enrolled in the two-year health administration, physical therapy, and public policy studies programs) will register for a minimum of 30 units of degree credit and for any course units beyond the 30 required of their program. A registration fee is charged each semester.

Approved transfer course work into a master's program will *not* reduce the minimum registration for a master's degree of 30 units at Duke University. Approved transfer of an earned master's degree may reduce the minimum doctoral registration to 45 units of degree credit at Duke University.

Full-time students will register at the rate of either 9 units as teaching or research assistants or 12 units each semester until the minimum units of degree credit have been completed. Part-time students will register for a minimum of 3 units per semester.

Students who are in residence during the summer session, but not enrolled in any courses, pay only the registration fee.

Except for these registration procedures, all other degree regulations remain as stated in the other sections of this bulletin.

All students who enrolled prior to 1985 should consult the bulletin of their year of matriculation for registration procedures and requirements.

Failure to maintain continuous registration each fall and spring semester will result in administrative withdrawal from the university.

Registration Periods. All students who are enrolled in the Graduate School and who have not been granted a leave of absence by the dean must register each fall and spring until all degree requirements are completed. New students will register immediately prior to the first day of classes in either term; continuing students register

during the announced registration periods in November and April. Students who have been on leaves of absence and who intend to resume a degree program must give the department and the Dean notice of this intention two months before registration.

Late Registration. All students are expected to register at the times specified by the university. A late registration fee of \$25 is charged any student registering late, including a current student who delays registering until the registration for new students.

Change of Registration. During the first two weeks of the fall or spring semester, registration may be changed with the approval of the director of graduate studies if no reduction of fee is entailed. If fees are reduced, the approval of the dean of the Graduate School is required and must be received no later than the first week of the semester.

Summer Registration. Students who are in residence at Duke University during the spring and who plan to enroll for courses in the summer session may have their course programs approved by the director of graduate studies during the week of Graduate School registration in March. Summer session students may register at announced time beginning with the March registration period and up to the Wednesday preceding the start of the appropriate term. Graduate students who intend to remain in residence during one or more of the summer session terms without registering for course work must either register for 1 unit of research (students who matriculated prior to fall 1985) or pay a summer registration fee (students who matriculated fall 1985 or later).

The university does not mail statements for summer session tuition and fees. All tuition and fees should be paid in the Office of the Bursar (101 Allen Building) at least *five full working days* prior to the first day of class (see summer session calendar). Students who fail to register and pay all tuition and fees before this deadline will be assessed a late charge. Failure to pay tuition and fees by the end of the drop/add period will result in administrative withdrawal of the student.

Summer session students may add a course or courses before or during the first three days of the term. Courses may also be dropped before and during the first three days, but a 20 percent tuition fee will be charged (1) if the course is not dropped before the first day, and (2) the dropped course(s) results in a total tuition reduction. Courses dropped after the third day of classes are not eligible for tuition refund.

Additional Registration Requirements. It is necessary to be a fully registered student according to the regulations listed in the chapter on "Registration" in order to be eligible for library carrel and laboratory space, student housing, university and some outside loans, and the Student Health Service, including accident and sickness insurance. See the chapter on "Student Life."



Regulations



General Academic Regulations

Credits. The following regulations pertain to credits earned outside the Duke University Graduate School:

Graduate Credit Earned before the A.B. Degree Is Granted. Ordinarily no credit will be allowed for graduate courses taken before a student has been awarded the A.B. or B.S. degree. However, an undergraduate student at Duke University, who at the beginning of the final semester lacks no more than three courses in order to fulfill the requirements of the bachelor's degree, may apply for admission to the Graduate School for that final semester. If the student meets the requirements for admission, permission may be obtained from the dean of the Graduate School to enroll for graduate courses to bring the total program to no more than five courses. In addition to undergraduate registration, the student must register in and pay tuition for those courses to the Graduate School at the beginning of the semester in which graduate credit is to be earned in order for the courses to be credited toward a graduate degree program.

Transfer of Graduate Credits. Transfer of up to 15 units of credit for graduate work completed at another school will be considered only after a student has earned a minimum of 12 units of graduate study at Duke University. After completing the 12 units, the student should file a request for transfer of credits on the appropriate Graduate School form.

Summer Session Credit. Summer session credit does not mean degree credit at Duke University unless the student has been admitted as a degree candidate by one of the colleges or schools of the university. The majority of summer session courses carry 3 units of credit and require one term of residence. A student taking a course for credit is expected to do all the work required and to take the final examination, and will receive a grade. (G. I. Bill benefits are available only to those veterans who enroll for credit.)

Grades. Grades in the Graduate School are as follows: *E*, *G*, *S*, *F*, and *I*. *E* (excellent) is the highest mark; *G* (good) and *S* (satisfactory) are the remaining passing marks; *F* (failing) is an unsatisfactory grade; and *I* (incomplete) indicates that some portion of the student's work is lacking, for an acceptable reason, at the time the grades are reported. For students enrolled in the Graduate School, the instructor who gives an *I* for a course specifies the date by which the student must make up the deficiency. For unclassified

graduate students enrolled in the summer session, a temporary *I* for a course may be assigned after the student has submitted a written request. If the request is approved by the instructor of the course, then the student must satisfactorily complete the work prior to the last day of classes of the subsequent summer term. If a course is not completed within one calendar year from the date the course ended, the grade of *I* becomes permanent and may not be removed from the student's record. The grade of *Z* indicates satisfactory progress at the end of the first semester of a two-semester course. A grade of *F* in a major course normally occasions withdrawal from a degree program not later than the end of the ensuing semester or term; a grade of *F* in any other course occasions academic probation.

Reciprocal or Interinstitutional Agreements with Neighboring Universities. Under a plan of cooperation between Duke University and the University of North Carolina at Chapel Hill, North Carolina Central University in Durham, and North Carolina State University at Raleigh, students properly enrolled in the Graduate School of Duke University during the regular academic year, and paying full tuition to this institution, may be admitted to a maximum of two courses per semester at one of the other institutions in the cooperative plan. A Ph.D. student who matriculated prior to fall semester 1985, who has passed the preliminary examination, and who registers for a minimum of 3 units at Duke, may register for 3 to 6 additional units at the other institution. Under the same arrangement, students in the graduate schools in the neighboring institutions may be admitted to course work at Duke University. Credit so earned is not defined as transfer credit. To take advantage of this arrangement during any summer session term, the student registers each term for 3 units of credit at the home institution and 3 units of credit at the other institution, for a total of 6 units. All interinstitutional registrations involving extra-fee courses or special fees required of all students will be made at the expense of the student and will not be considered a part of the Duke University tuition coverage. This reciprocal agreement does not apply to contract programs such as the American Dance Festival.

Identification Cards. Graduate students are issued identification cards which they should carry at all times. The card is a means of identification for library privileges, athletic events, and other university functions or services open to them as university students. Students will be expected to present their cards on request to any university official or employee. The card is not transferable, and fraudulent use may result in loss of student privileges or suspension from the Graduate School. A report of the loss of a card must be given immediately to the registrar's office. The cost of a new ID card is \$5.

Courses Primarily for Undergraduates. In exceptional circumstances and with the approval of their director of graduate studies, students may take any course(s) below the 200 level and have it (them) count toward the requisite 60 units, provided that two conditions are met:

- a. that such courses be over and above the graduate course requirements set by the department; and
- b. that a grade of *B* or better be earned.

At the master's level, only two such courses will be counted toward the 30 units.

Withdrawal from a Course. For permissible changes during the first two weeks of the fall or spring semester and during the first three days of summer session term, see the chapter on "Registration." If a course is dropped without the necessary approval, the permanent record will, at the discretion of the dean of the Graduate School and with the permission of the instructor, list the course as *Withdrawal Error* (WE). If a course is dropped after the two-week period during the fall or spring or after the first three days of classes during the summer, the status of the student at the time of withdrawal from the course will be determined and indicated on the permanent record as *Withdrew Passing* (WP) or *Withdrew Failing* (WF).

Interruption of Program and Withdrawal from the Graduate School. Students are expected to meet academic requirements and financial obligations, as specified elsewhere in this bulletin, in order to remain in good standing. Certain nonacademic rules and regulations must be observed also. Failure to meet these requirements may result in *summary* dismissal by the appropriate officer of the university.

The university reserves the right, and matriculation by the student is a concession to this right, to request the withdrawal of any student whose academic performance at any time is not satisfactory to the university. A student who wishes for any reason to withdraw from the Graduate School during the fall, spring, or summer session should notify in writing both the director of graduate studies in the major department and the dean of the Graduate School prior to the date of the expected withdrawal and no later than the published last day of classes for that semester or summer session. If students wish to withdraw from courses in the summer session, they must consult both the director of graduate studies in the major department and the director of the Summer Session. For refunds upon withdrawal, see the chapter on "Financial Information."

A student who, after successfully completing one semester of graduate study, must withdraw before completion of a graduate program may, with the approval of the major department, request the dean to issue a certificate of graduate study.

Leave of Absence. A leave of absence for a period of time no longer than one calendar year may be granted because of medical necessity, full-time employment, acceptance of an external award judged likely to benefit the student as an individual but not related to the degree requirements, or other acceptable reasons. A request for a leave of absence should be originated by the student, endorsed by the student's major professor and director of graduate studies, and submitted to the dean of the Graduate School for consideration prior to the beginning of the semester for which the leave is requested. A student is eligible to request a leave of absence only after having completed at least one semester at Duke. Time limitations which pertain to the various degrees and the completion of courses on which a grade of *I* (incomplete) was earned are not waived.

English for Academic Purposes. International graduate students may take advantage of a three-hour credit course designed to familiarize them with the structures and expectations of academic English, both spoken and written. English 200 is neither a remedial course nor a conversational course, but is advanced-level preparation for the papers and presentations required of the graduate student and professional.

Degree Regulations—The Master's Degrees

MASTER OF ARTS

Prerequisites. As a prerequisite to graduate study in the major subjects, a student must have completed a minimum of 24 undergraduate semester hours—ordinarily 12 semester hours of approved college courses in the major subject and 12 semester hours in the major or in related work. Since some departments require more than 12 semester hours in the proposed field of study, students should read carefully the special requirements listed by their major departments in the chapter on "Courses of Instruction." If special master's requirements are not specified in this chapter and there is a question about the prerequisite, prospective students should write directly to the appropriate Director of Graduate Studies.

Language Requirements. The Graduate School requires no foreign language for the master's degree. Certain departments, however, do have language requirements and these must be satisfied before the master's examination can be taken. See the departmental listings in the chapter on "Courses of Instruction."

Major and Related Subjects. Thirty units of graduate credit at Duke constitutes minimum enrollment for the Master of Arts degree. The students must present accept-

able grades for a minimum of 24 units of graded course work, 12 of which must be in the major subject. A minimum of 6 units of the required 24 must be in a minor subject or in related fields which are approved by the student's major department. The remaining 6 units of the required 24 may be taken either in the major or in related fields approved by the major department and the Dean of the Graduate School.

Individual departments decide whether the M.A. program may be completed by submission of an approved thesis or by other academic exercises (see requirements listed in the chapter on "Courses of Instruction"). In either case, a maximum of 6 units may be earned by the completion exercises and the final examination.

Thesis Requirements. The thesis should demonstrate the student's ability to collect, arrange, interpret, and report pertinent material on a research problem. The thesis must be written in an acceptable style and should exhibit the student's competence in scholarly procedures. Requirements of form are set forth in the *Duke University Guide for the Preparation of Theses and Dissertations*, copies of which are available in the Graduate School office.

The thesis must be submitted in an approved form to the dean of the Graduate School on or before April 15 for a May degree, one week before the final day of the Duke University second summer term for a September degree, one week before the final day of the fall semester for a December degree, and at least one week before the scheduled date of the final examination. The copies of the thesis then will be distributed by the student to the several members of the examining committee. Two copies for the library and one copy for the adviser will be bound upon payment of the university binding fee of \$25.

The Examining Committee and the Examination. The department's director of graduate studies recommends an examining committee composed of three members of the graduate faculty, one of whom usually must be from a department other than the major department. If the student has been permitted to take related work within the major department, the third member may be chosen from within the department. Nominations for membership on this committee are submitted for approval to the dean of the Graduate School at least one week preceding the final examination.

The committee will conduct the examination and certify the student's success or failure by signing the card provided by the Graduate School office. This card indicates completion of all requirements for the degree. If a thesis is presented, the committee members also sign all copies of the thesis, and the candidate then returns the original and first two copies to the Graduate School office.

MASTER OF SCIENCE

Prerequisites. A bachelor's degree is a prerequisite for the M.S. degree. Departments offering an M.S. degree consider for admission students from allied fields provided they have satisfactory scientific and mathematical backgrounds.

Language Requirements. There is no foreign language requirement in Master of Science degree programs.

Major and Related Subjects. Thirty units of graduate credit at Duke constitutes minimum enrollment for the Master of Science degree. The student must present acceptable grades for a minimum of 24 units of graded graduate courses. Of these, at least 12 units must be in the major subject. A minimum of 6 units must be in a minor subject or in related fields which are approved by the student's major department. The remaining 6 units of the required 24 may be taken either in the major or in related fields approved by the major department and by the dean of the Graduate School. A maximum of 6 units may be earned either by submission of an approved thesis, or by completing courses or other academic activities approved by the student's department. As other

requirements vary according to department, please consult the chapter on "Courses of Instruction" for further information.

Thesis and Examination. Some departments require a thesis; all departments require an examination. The regulations and options for theses and other means of completing the program, as well as the provisions for examination and the examining committee, are the same as the requirements for the Master of Arts degree.

Additional Master's Regulations

Filing the Intention to Receive Degree. On or before February 1 for a May degree, on or before August 1 for a September degree, or on or before December 1 for a December degree, and at least one month prior to the final examination, the student must file in the Office of the Graduate School, on the official form, a declaration of intention to graduate. The declaration of intention presents the title of the thesis or specifies alternative academic exercises on which the degree candidate will be examined. During their final semester students may not change from a thesis program to a nonthesis program or from a nonthesis program to a thesis program after this form has been filed with the Graduate School office. The declaration must have the approval of both the director of graduate studies in the major department and the chair of the student's advisory committee.

Transfer of Credits. A maximum of 6 accredited units of graduate credit may be transferred for graduate courses completed at other schools. Such units will be transferred only if the student has received a grade of *B* (or its equivalent) or better. The transfer of graduate credit does not reduce the required minimum registration of 30 units for a master's degree at Duke. Requests for transfer should be submitted on the approved Graduate School form.

Nondegree Students. Credit for graduate courses taken at Duke by a student (not undergraduate) before degree admission to the Graduate School or while registered as a nondegree student through the Office of Continuing Education or the Graduate School may be carried over into a graduate degree program if (1) the action is recommended by the student's director of graduate studies and approved by the dean, (2) the amount of such credit does not exceed 12 units, (3) the work has received grades of *G* or better, (4) the work is not more than two years old, and (5) the student applies for and is granted formal admission into a degree program.

Time Limits for Completion of Master's Degrees. Master's degree candidates who are in residence for consecutive academic years should complete all requirements for the degree within two calendar years from the date of their first registration in the Graduate School. Candidates must complete all requirements within six calendar years of their first registration.

To be awarded a degree in May, the recording of transfer credit must be completed by the first day of the final examination period. If a thesis is one of the requirements, it must be submitted to the Graduate School office no later than April 15. Candidates desiring to have their degrees conferred on September 1 must have completed all requirements, including the recording of transfer of credit, by the final day of the Duke University summer session. Candidates completing degree requirements after that date and during the fall will have their degrees conferred on December 30.

Degree Regulations—The Doctoral Degree

Requirements. The formal requirements for the Ph.D. degree are as follows: (1) major and related courses, (2) foreign language(s) in many departments, (3) a supervisory committee for the student's program of study, (4) residence, (5) preliminary examination, (6) dissertation, and (7) final examination.

Major and Related Work. The student's program of study demands substantial concentration on courses in the major department. However, a minimum of 6 units in a related field approved by the major department must be included. A few programs have been authorized by the Executive Committee of the Graduate Faculty to utilize courses in fields within the major department in fulfilling the related field requirement. If there are deficiencies in a student's undergraduate program, departments may require certain undergraduate courses to be taken. In all cases the student's supervisory committee will determine if the student must meet requirements above the minimum.

Foreign Languages. The Graduate School has no foreign language requirement for the Ph.D. Some departments require two languages; other departments have no foreign language requirements. For specific departmental requirements, see the chapter on "Courses of Instruction" or contact the appropriate director of graduate studies.

Students working toward the doctoral degree in a department requiring a foreign language(s) must complete this requirement before taking the preliminary examination.

Committee to Supervise the Program of Study. As early in a student's course of study as is practicable and not later than two months before the preliminary examination, the director of graduate studies in the major department will nominate for the approval of the dean a supervising committee consisting of five members, with one member designated as chair. This committee will include at least three graduate faculty members of the major department and, usually, at least one from outside the department. For programs in which approval has been granted for related work from a clearly differentiated division within the department, one member of the committee will be chosen from that division. This committee, with all members participating, will determine a program of study and administer the preliminary examination.

Residence. The minimum residence requirement is one academic year (two consecutive semesters in the same academic year) of full-time registration at Duke (that is, registration of 12 units each semester or, in the case of graduate assistants, 9 units each semester). The minimum registration requirement is 60 units of graduate degree credit, of which not more than 15 units of a completed master's degree may be accepted by transfer. Such transfer of credit will not reduce the minimum requirement of one full-time academic year at Duke.

Time Limits. Ordinarily a student registered for full-time study should pass the preliminary examination by the end of the third year. A student who has not passed the examination by the end of this time must file with the dean of the Graduate School a statement, approved by the director of graduate studies in the major department, explaining the delay and setting a date for the examination. Except under unusual circumstances, extension will not be granted beyond the middle of the fourth year.

The doctoral dissertation should be submitted and accepted within two calendar years after the preliminary examination is passed. Should the dissertation not be submitted and accepted within four years after the examination, the candidate, with the approval of the committee, may petition the dean of the Graduate School for an extension of up to one year. If this extension is granted and the dissertation is not submitted and accepted by the new deadline, the student will be dropped from candidacy. The student must then pass a second preliminary examination to be reinstated as a candidate for the degree. In such cases, the time limit for submitting the dissertation will be determined by the dean of the Graduate School and the candidate's committee.

Ordinarily, credit is not allowed for graduate courses (including transfers) or foreign language examinations that are more than six years old at the date of the preliminary examination. Similarly, credit will not be allowed for a preliminary examination that is five years old at the date of the final examination. In cases of exceptional merit, however, the dean of the Graduate School may extend these limits. Should the five-year limits be

exceeded, the student's department must submit to the dean specific requirements for revalidating credits.

Preliminary Examination. A student is not accepted as a candidate for the Ph.D. degree until the preliminary examination has been passed. The examination ordinarily covers both the major field and related work, although some departments cover such field expertise in a separate qualifying examination. Please consult the chapter on "Courses of Instruction" for individual department procedures. In the summer a preliminary examination may be scheduled only between the opening and closing dates of the summer session.

A student who fails the preliminary examination may apply, with the consent of the supervisory committee and the dean of the Graduate School, for the privilege of a second examination to be taken no earlier than three months after the date of the first. Successful completion of the second examination requires the affirmative vote of all committee members. Failure on the second examination will render a student ineligible to continue a program for the Ph.D. degree at Duke University.

The Dissertation. The dissertation is expected to be a mature and competent piece of writing, embodying the results of significant and original research.

One month before the dissertation is presented and no later than February 1 preceding the May commencement, August 1 for a September degree, and December 1 for a December degree, the student must file with the dean of the Graduate School, on the official form available in the Graduate School office, the title of the dissertation. This title must receive the written approval of both the director of graduate studies of the student's major department and the professor who directs the dissertation.

The basic requirements for preparing the dissertation (type of paper, form, and binding) are prescribed in the *Guide for the Preparation of Theses and Dissertations*, copies of which are available in the Graduate School office.

The dissertation must be completed to the satisfaction of the professor who directs the dissertation, members of the student's advisory committee, and the dean of the Graduate School. A copy of the dissertation must be submitted to the dean of the Graduate School on or before April 1 preceding the May commencement, one week before the end of the Duke summer session for a September degree, or one week before the end of the fall semester for a December degree. The dissertation must be submitted to the Graduate School office at least seven days before the scheduled date of the student's examination.

All doctoral dissertations are published on microfilm through University Microfilms, Ann Arbor, Michigan. Authors may copyright them if they wish. Abstracts are published in *Dissertation Abstracts International*.

Two extra copies of the abstract (not more than 350 words long) are submitted when the dissertation is presented to the Graduate School office. A nonrefundable fee of \$45 is charged for microfilming. If copyright is desired, an additional fee of \$35 is charged. The original and two copies will be bound at a cost of \$25.

Final Examination. The final examination is normally administered by the five members of the supervising committee, but it may be administered by four members of the committee if the member representing the related field is present. In either case, successful completion of the final examination requires at least four affirmative votes. The final oral examination shall be primarily on the dissertation; however, questions may be asked in the candidate's major field. Except in unusual circumstances approved by the dean, a final examination will not be scheduled when the university is not in session.

A student who fails the final examination may be allowed to take it a second time, but no earlier than six months from the date of the first examination. Permission to take the second examination must be obtained from the professor who directed the dissertation and

from the dean of the Graduate School. Failure to pass the second examination renders the student ineligible to continue work for the Ph.D. degree at Duke University.

Deposit of the Dissertation. After passing the examination, candidates bring to the Graduate School office the original and the first two copies of the dissertation, properly signed. At this time they sign the microfilming agreement and pay microfilming and copyright fees.

Commencement

Graduation exercises are held once a year, in May, when degrees are conferred on and diplomas are issued to those students who have completed requirements by the end of the spring. Those who complete degree requirements by the end of the fall or by the end of a summer term receive diplomas dated December 30 or September 1, respectively. There is a delay in the mailing of September and December diplomas because diplomas cannot be issued until they are approved by the Academic Council and the Board of Trustees.

Standards of Conduct

Duke University expects and will require of all its students cooperation in developing and maintaining high standards of scholarship and conduct.

Students are expected to meet academic requirements and financial obligations, as specified elsewhere in this bulletin, in order to remain in good standing. Certain nonacademic rules and regulations must be observed also. Failure to meet these requirements may result in *summary* dismissal by the appropriate officer of the university.

The university wishes to emphasize its policy that all students are subject to the rules and regulations of the university currently in effect or which, from time to time, are put into effect by the appropriate authorities of the university. Students, in accepting admission, indicate their willingness to subscribe to and be governed by these rules and regulations and acknowledge the right of the university to take such disciplinary action, including suspension and/or expulsion, as may be deemed appropriate for failure to abide by such rules and regulations or for conduct adjudged unsatisfactory or detrimental to the university.

Duke University, as a community of scholars, strongly relies upon the standard of academic integrity. Plagiarism and other forms of academic dishonesty represent a corruption of this integrity and, as such, cannot be tolerated within the community. Ignorance of what constitutes academic dishonesty is no excuse for actions which violate the integrity of the community. In a community which builds on the notion of academic integrity, the threat of academic dishonesty represents an intolerable risk. Students unsure about the university definition of plagiarism may wish to consult the *Bulletin of Duke University: Information and Regulations* (especially the chapter on "Academic Honesty").

Sexual Harassment Procedures. A committee of students, faculty, and administrators exists at Duke to respond to concerns about sexual intimidation in any form. For confidential assistance and information on procedures, contact Professor Nancy Hewitt (Department of History), 684-2505.

Student Grievance Procedures. It is the responsibility of the director of graduate studies to inform each graduate student of the appropriate channels of appeal. In normal circumstances, the director of graduate studies is the first to hear a complaint. If the complaint cannot be resolved satisfactorily at this level, the student may address, in turn, the department chair, the associate dean of the Graduate School, the dean of the Graduate School, the provost, and as a last resort, the president of the university.

Judicial Code and Procedures. In the spring of 1971, the Graduate School community ratified and adopted the following official judicial code and procedures:

I. Graduate School Judicial Code and Procedures

A. A student, by accepting admission to the Graduate School of Duke University, thereby indicates willingness to subscribe to and be governed by the rules and regulations of the University as currently are in effect or, from time to time, are put into effect by the appropriate authorities of the University, and indicates willingness to accept disciplinary action, if behavior is adjudged to be in violation of those rules or in some way unacceptable or detrimental to the University. However, a student's position of responsibility to the authorities and the regulations of the University in no way alters or modifies responsibilities in relation to civil authorities and laws.

B. A graduate student at Duke University stands in a primary and unique relation of responsibility to the faculty in the major department, the faculty upon whose recommendation a graduate degree will or will not be awarded to the student. In matters which involve or may affect the student's intellectual or professional life, the student is directly responsible to this department and its representatives, and such matters should primarily be handled by the department.

C. Actions which appear to conflict with University-wide rules and regulations will fall under the jurisdiction of the University Judicial Board.

D. A student may elect to have the Dean of the Graduate School hear matters related to the student's conduct in addition to or instead of faculty members from the student's major department, or may elect to have such matters reviewed and judged by a judicial board instead of the Dean of the Graduate School or members of the faculty in the major department. (The constitution and procedure of the judicial board are detailed below.)

E. The Director of Graduate Studies in the student's major department may request that a student's actions be reviewed by the Judicial Board or by the Dean of the Graduate School.

II. The Graduate School Judicial Board

A. *Composition.* The Graduate School Judicial Board shall have five members, serving for a period of two years: two students selected from the student body, two members of the Graduate Faculty appointed by the Executive Committee of the Graduate School, and one Associate or Assistant Dean appointed by the Dean of the Graduate School. The Board shall elect one of its members as Chairman. The Board shall have at its service a recording secretary to keep minutes of the hearings and of the Board's actions in a permanent, confidential record book. The Board will be constituted in order to hear cases in which the accused is a student currently enrolled in the Graduate School and which have been referred to it by the Director of Graduate Studies in the student's department, by the Dean of the Graduate School, or by the student himself.

B. *Preliminary Procedures.* If a student requests a hearing by the Judicial Board it must be done in writing, allowing its Chairman at least seventy-two hours to convene the Board. In addition, the Chairman shall not convene the Board until seventy-two hours after being asked to convene the Board. It is the responsibility of the Chairman of the Judicial Board fully to inform its members concerning the case and the reasons the case has been referred to the Board; and to prepare a written summary of this information for the Board, the Dean, and the student.

C. *Procedural Safeguards for the Hearing.* The Accused has the right to challenge any member of the Judicial Board on grounds of prejudice. If the Board decides to excuse one or more of its members for reasons given by the Accused, it shall consult with the Dean about the need for replacements. The Accused may choose an Adviser to assist in the defense. The Accused may also produce witnesses (including no more than two character witnesses), introduce documents, and offer testimony. A person having direct knowledge relevant to a case being heard by the Board is a material witness. The Judicial Board may request the appearance of material witnesses. The Board shall also request, upon written request of the Complainant or the Accused, the appearance of material witnesses. Witnesses shall be notified of the time, place, and purpose of their appearance. The Accused has the right to examine the written statement of any witness relevant to the case at least seventy-two hours before the hearing. The Accused has the right to be faced with any witness who has given a statement relevant to the case at the hearing if the witness's attendance can be secured.

The hearing will be conducted in private unless the Accused requests an open hearing. If any objection is raised to conducting an open hearing in any particular case, the Judicial Board shall decide the issue by majority vote. If the decision is made not to hold an open hearing, the Accused shall be informed in writing of the reasons for the decision.

The Judicial Board shall consider only the report of the Chairman, documents submitted into evidence, and the testimony of witnesses at the hearing in reaching its decisions.

D. *Conduct of the Hearing.* The hearing of any case shall begin with a reading of the charge by the Chairman in the presence of the Accused. The Accused shall then plead guilty or not guilty or move to terminate or postpone the hearing. The Accused may qualify a plea, admitting guilt in part and denying it in part. The Accused may not be questioned for more than one hour without recess.

At any time during the hearing, the Accused or the Judicial Board may move to terminate or to postpone the hearing or to qualify the plea or to modify its charge.

Pending verdict on charges (including appeal) against the Accused, status as a student shall not be changed, nor the right to be on campus or to attend classes suspended, except that the Chancellor or Provost may impose an interim suspension upon any member of the University community who demonstrates, by conduct, that continued presence on the campus constitutes an immediate threat to the physical well-being or property of members of the University community or the property or orderly functioning of the University.

E. Sanctions and the Verdict. The Graduate School Judicial Board shall have the power to impose the following penalties: expulsion, dismissal from the University with the recommendation that the person never be readmitted; suspension, dismissal from the University and from participation in all University activities for a specified period of time, after which the student may apply for readmission; disciplinary probation, placing the student on a probationary status for a specified period of time, during which conviction for violation of any regulation may result in more serious disciplinary action; restitution, payment for all, or a portion of property damage caused during the commission of an offense. Restitution may be imposed by itself or in addition to any of the other penalties. The judgment shall consist of a finding of guilty or not guilty of the charge and, when the Accused is found guilty, a statement of the punishment assessed. On all questions, including the verdict and the finding of guilty or not guilty, the Board shall be governed by a majority vote. The Judicial Board may decide to rehear a case in which significant new evidence can be introduced. In addition, the defendant may request an appeal.

F. Appeals. The appellant may submit to the Dean a written statement containing the grounds for appeal and arguments. In such cases, the Dean should determine if the appeal should be granted, and the Dean can hear the case, or refer it to the appropriate faculty in the student's department or to the Judicial Board.

An appeal shall be granted on the following grounds: procedural error substantially affecting the rights of the accused; incompatibility of the verdict with the evidence; excessive penalty not in accord with "current community standards;" new evidence of a character directly to affect the judgment but on which the original tribunal had refused a new hearing.

III. Amendment and Construction

This Judicial code and procedure and this constitution and procedure for the Graduate School Judicial Board may be amended at any time with due notice or publication by consent of the Dean, the Executive Committee, and the graduate students. Questions and problems not answered or anticipated by the foregoing may be resolved by the use of other existing institutions or by amendment.



Courses of Instruction



Course Enrollment

Courses numbered 200-299 are sometimes open to qualified undergraduate students who have received permission of the instructor and the director of graduate studies. Undergraduate students are not permitted in any courses above 300. Odd-numbered courses are usually offered in the fall semester, even-numbered courses in the spring semester. Double numbers separated by a hyphen indicate that credit is contingent upon completion of both courses. Double numbers separated by a comma indicate that although the course is a yearlong course, credit may be received for either course or both courses.

In each department the number 399 is reserved to designate special (individual) readings in a specified area and supervised by a regular member of the graduate staff, with credit of 1-3 units each registration, only one course per registration, and 9 units maximum in three successive registrations. The course is restricted to resident master's and doctoral programs, must have a completion exercise, and must carry a grade.

The following symbols, suffixed to course numbers, identify the small group learning experiences: *S*, seminar; *P*, preceptorial; *T*, tutorial; *D*, discussion section. The *L* suffix indicates that the course includes laboratory experience. *C-L*: denotes a course that is cross-listed or a program under which a course is listed.

Art and Art History

Professor Bruzelius, *Chair* (112A East Duke Building); Assistant Professor Cernuschi, *Director of Graduate Studies* (114A East Duke); Associate Professor Wharton; Assistant Professors Powell, Rice, Stiles, and Van Miegroet; Professors Emeriti Jenkins, Markman, Spencer, and Sunderland; Adjunct Professors Lee and Mezzatesta; Adjunct Assistant Professor Reents-Budet

The Department of Art and Art History offers graduate work leading to the Ph.D. degree in art history. The program, which has a strong interdisciplinary component, provides students with a thorough grounding in the formal and iconographic aspects of artworks and monuments as well as in their theoretical and historical context. Course work has been designed to prepare students for careers in art and architectural criticism, research and teaching in the academy, museum, and art gallery.

Concurrently with their work toward a Ph.D., students may satisfy the requirements for a Certificate of Museology. Students are required to have demonstrated their ability

to read German, French, and any other language relevant to their chosen area of research by the beginning of their second year. For further information on the program, prospective applicants may write to the director of graduate studies.

Applicants to the program in Art History should provide a copy (not returnable) of a research paper (8-10 pages) as a writing sample.

For Seniors and Graduates

201S. Topics in Greek Art. Specific aspects of the art or architecture in the Greek world from the late Geometric to the Hellenistic periods. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 220S. 3 units. *Staff*

202S. Topics in Roman Art. Selected topics in the art and architecture of late republican and imperial Rome. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 227S. 3 units. *Staff*

205S. Greek Architecture. See C-L: Classical Studies 233S. 3 units. *Richardson or Younger*

216. The Art of the Counter Reformation. Religious art in Gothic Europe during and following the Council of Trent. Issues such as the rise of the new religious orders; the revival of interest in the early Church and the origins of Christian archaeology; the Church's use of art in its war against Protestantism. The validity of the concept of a counter reformation style. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

227S. Roman Painting. See C-L: Classical Studies 236S. 3 units. *Richardson*

233S. Topics in Early Christian and Byzantine Art. Specific conceptual, institutional, or formal problems in the art of the late antique world or of the east Roman Empire. Subject varies from year to year. Consent of instructor required. C-L: Classical Studies 230S, Medieval and Renaissance Studies, and Religion 275S. 3 units. *Wharton*

236S. Topics in Romanesque and Gothic Art and Architecture. Analysis of an individual topic. Subject varies from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. 3 units. *Bruzeliuss*

237S. Greek Painting. See C-L: Classical Studies 232S. 3 units. *Stanley*

238S. Greek Sculpture. See C-L: Classical Studies 231S. 3 units. *Younger*

243S. Topics in Netherlandish and German Art. Specific problems in northern Renaissance or baroque art such as the Antwerp workshops of the sixteenth century or a critical introduction to major artists such as Van Eyck, Bosch, Dürer, and Rubens. An analytical approach to their lives, methods, atelier procedures and followers; drawings and connoisseurship problems; cultural, literary, social, and economic context; documentary and scientific research strategies. Subject varies from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. 3 units. *Van Miegroet*

244S. International Expressionism. A synchronic view of the expressionist revolution in modern aesthetic conceptions throughout Europe in the period 1905-1925, emphasizing fusions of established aesthetic modes with new technological media, and the opening up of the Western tradition to other cultures, especially African. German expressionism forms the nucleus of the course and its study is integrated with the theory and practice of Italian futurism, Anglo-American imagism and vorticism, French surrealism, and Russian rayonnism. C-L: German 244S. 3 units. *Cernuschi and Rolleston*

247S. Topics in Italian Renaissance Art. Specific problems dealing with iconography, style, or an individual master from c. 1300 to 1600. Subject varies from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

257S. Topics in Pre-Columbian Art and Culture. Selected topics in pre-Columbian art and archaeology with an emphasis on the political and cultural context of the artifact. Subject varies from year to year. Consent of instructor required. 3 units. *Reents-Budet*

260S. Topics in Italian Baroque Art. Problems in Italian art and architecture from c. 1580 to c. 1750. Topics vary from year to year. Consent of instructor required. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

265S. Topics in Nineteenth-Century Art. Focus on a major artist, movement, or trend in nineteenth-century art. Subject varies from year to year. Consent of instructor required. 3 units. *Cernuschi or Stiles*

270S. Topics in African Art. Specific problems of iconography, style, or a particular art tradition. Subject varies from year to year. Consent of instructor required. 3 units. *Powell*

271S. Topics in Art of the United States. Selected topics from colonial times to 1945, with emphasis on major cultural issues, movements, works, and/or artists. Consent of instructor required. 3 units. *Powell or Stiles*

283S. Topics in Modern Art. Selected themes in modern art before 1945, with emphasis on major movements or masters. Subject varies from year to year. Consent of instructor required. 3 units. *Cernuschi or Stiles*

291, 292. Independent Study/Special Problems in Art History. Directed reading and research. Consent of instructor required. 3 units each. *Staff*

294. Maya Art and Culture. The ancient Maya civilization of Mexico, Guatemala, and Belize explored through study of their material culture. Mayan religious and political iconography in conjunction with Mayan hieroglyphic writing. Approaches include those of archaeology, ethnohistory, and linguistics. 3 units. *Reents-Budet*

295. Pre-Columbian Art and Culture of Andean South America. The art of Peru, Bolivia, Ecuador, and Colombia from the beginnings of permanent settlements through the coming of the Spaniards (1534 A.D.), concentrating on sociopolitical and religious institutions. 3 units. *Reents-Budet*

296S. Methodology of Art History. Approaches to the study and theory of art: historiography, connoisseurship, iconology, and criticism. Consent of instructor required. 3 units. *Staff*

297S. Topics in Art since 1945. Historical and critical principles applied to present-day artists and/or movements in all media since World War II. Consent of instructor required. 3 units. *Cernuschi or Stiles*

298S. Topics in Modern and Postmodern Architecture. The study of particular architects, movements, or building genres in their conceptual and political contexts. Subject varies from year to year. Consent of instructor required. 3 units. *Wharton*

299S. Critical Theory. Understanding of the visual arts in terms of the theoretical developments in other disciplines (for example, literature, women's studies, Marxism, and anthropology). Focus on the writings of theory-centered art historians and critics. Consent of instructor required. 3 units. *Cernuschi, Stiles, or Wharton*

For Graduates

220. The Art of Egypt and the Ancient Near East. Art and architecture of the major urban centers of Egypt, Syria-Palestine, Mesopotamia, and Iran from the fourth millennium B.C. to the conquest of Alexander. Emphasis on architecture, sculpture, and painting. 3 units. *Staff*

221. The Art of Ancient Italy. Art and architecture in Italy from the Villanovan period to the late Roman Republic. Emphasis on relations among the Etruscans, early Rome, and the Greek cities of the South. 3 units. *Staff*

222. Art and Myth in Ancient Greece. Art in relation to myth in Greek society from the Orientalizing to the Hellenistic period. Emphasis on architectural sculpture and painting; connections between monumental and small-scale arts. 3 units. *Staff*

225. The City in Antiquity. Urban architecture and city planning in the ancient Near East and the classical world. Forms and development of the urban environment as a function of religious, political, and economic factors from the beginnings of Mesopotamia to the centers of Hellenistic Greece and the Roman Empire. 3 units. *Staff*

228. Art of the Roman Empire. Art and architecture in the Roman world from Augustus to Theodosius. Emphasis on portraiture, private arts, and triumphal monuments. 3 units. *Staff*

229. The History of Prints and Printmaking. The art of printmaking from the fifteenth through the eighteenth centuries. The impact of the invention of printing; technical and artistic innovations; the contributions of individual artists from Mantegna to Tiepolo. Firsthand experience of basic printmaking techniques in the studio; study of original works of art on frequent trips to local museums and libraries. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

230. Late Antique Christian Art. Art and architecture of the Christian community from the third to the fifth century in the context of the Roman imperial state. 3 units. *Wharton*

231. Art of the Early Middle Ages. Survey of Early Christian, Byzantine, Carolingian, and Ottonian art and architecture. Focus on the impact of church and empire on the form and function of artworks from the third to eleventh centuries. C-L: Medieval and Renaissance Studies. 3 units. *Bruzeliuss or Wharton*

232. Art of the Late Middle Ages. Romanesque and Gothic art and architecture from the eleventh through the fourteenth centuries. The artistic impact of monasticism, pilgrimage, the Crusades, and urbanization. The role of ecclesiastic, civic, and courtly patrons. C-L: Medieval and Renaissance Studies. 3 units. *Bruzeliuss or Wharton*

234. Medieval Architecture. The development of medieval architecture through the mid-fourteenth century. Emphasis on churches, with some discussion of castles and fortifications, town planning, and domestic architecture. C-L: Medieval and Renaissance Studies. 3 units. *Bruzeliuss*

235. Gothic Cathedrals. Major monuments of Gothic architecture in the twelfth and thirteenth centuries on the continent and in England with concentration on the great cathedrals of France. C-L: Medieval and Renaissance Studies. 3 units. *Bruzeliuss*

239. Aspects of Medieval Culture. A study of historical, literary, philosophical, and art historical materials introducing medieval culture and the methods developed for its study. C-L: Medieval and Renaissance Studies. 3 units. *Bruzeliuss or Wharton*

240. Giotto and the Origins of the Renaissance. Painting and sculpture in Italy, with emphasis on Pisano, Duccio, Giotto, and the crisis of the Black Death. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

241. Fifteenth-Century Italian Art. Painting, sculpture, and architecture from Masaccio, Donatello, and Brunelleschi to Leonardo. Emphasis on the art of Florence. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

242. Sixteenth-Century Italian Art. Painting and sculpture in Rome and Florence: Michelangelo, Raphael, Leonardo. The rise and diffusion of mannerism: Pontormo to Tintoretto. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

245. Renaissance Art in Florence. Paintings, sculpture, and architecture from Giotto to Michelangelo based on the works of art preserved in Florence. Emphasis on individual artists and their creations and on the relation of the artists to the society of their times. (Taught in Italy.) C-L: Medieval and Renaissance Studies. 3 units. *Rice*

246. Italian Renaissance Architecture. Development of building types and city planning in the fifteenth and sixteenth centuries in central and northern Italy. Emphasis on Brunelleschi, Alberti, Bramante, Michelangelo, and Palladio. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

248. Art of the Netherlands in the Fifteenth Century. Early Netherlandish painting in the Burgundian Netherlands from Hubrecht and Jan Van Eyck to Gerard David and Hieronymus Bosch. Cultural, historical, and intellectual environment in Flanders and Brabant; civic and courtly patronage in Doornik (Tournai), Ghent, Bruges, Mechlin, and Antwerp; new research strategies of contemporary evidence. C-L: Medieval and Renaissance Studies. 3 units. *Van Miegroet*

249. Aspects of Renaissance Culture. A study of historical, literary, philosophical, and art historical materials introducing Renaissance culture and the methods developed for its study. C-L: Medieval and Renaissance Studies. 3 units. *L. Patterson and Van Miegroet*

250. Italian Baroque Architecture. Architecture in Italy in the seventeenth and eighteenth centuries. Emphasis on the contributions of Bernini, Borromini, Cortona, Guarini, and Juvarra. The evolution of building types, both secular and religious; town planning; garden and landscape history. Special attention to the cultural, economic, and political forces that shaped the Baroque city. C-L: Medieval and Renaissance Studies. 3 units. *Rice*

251. Art of Italy in the Seventeenth Century. Caravaggio, the Carracci, Guido Reni, Domenichino, Bernini, and Poussin. Modes of description and narration; the concern with the status of pictorial representation; and the attempts to define and retrieve the canonical achievements of the early sixteenth century. 3 units. *Rice*

252. Art of the Netherlands in the Sixteenth Century. Painting in Antwerp and the Spanish Netherlands in a period of political turbulence (Reformation, Counter-Reformation); Pieter Bruegel, Frans Floris, Hendrick Goltzius; landscape painters and the exiles at Frankenthal; Flemish painters at the court of Rudolph II in Prague; art and politics in Flanders, Brabant, and Holland. C-L: Medieval and Renaissance Studies. 3 units. *Van Miegroet*

253. Art of the Northern Netherlands in the Seventeenth Century. A contextual study of northern Netherlands art, seen through the major Dutch cities and towns where painters, such as Frans Hals and Johannes Vermeer, were at work. Rembrandt and his school; Dutch art in its historical, societal, moral, and psychological context. C-L: Medieval and Renaissance Studies. 3 units. *Van Miegroet*

254. German Art in the Fifteenth and Sixteenth Centuries. An examination of German art, including Stefan Lochner, Konrad Witz, Albrecht Dürer, and Hans Holbein the Younger; the significance of the Councils of Konstanz and Basel; the revolutionary impact of the printing press. New trends in sculpture, including the relatively unknown wood carvings created in Nuremberg between 1475 and 1515. C-L: Medieval and Renaissance Studies. 3 units. *Van Miegroet*

255. Mercantile Culture and Art in the Netherlands. The mercantile culture and its relationship with art and the occupation of artist in the Netherlands (fifteenth-seventeenth centuries, with main stress on seventeenth). The economy of towns, the artist's social position, the place of art in the local economy, and the connections between economic well being and the emergence of art as asset. Commercial evolution: institutions (markets, bans, stock exchanges), instruments (for example, the bill of exchange), and attendant conditions (risk, speculations, panics). The peculiarities of Dutch picturing, the role of art as moveable product, liquidity and store of value. 3 units. *de Marchi and Van Miegroet*

256. Art of the Southern Netherlands in the Seventeenth Century. The artistic preeminence of Antwerp in the southern Netherlands from Jan I Bruegel to Pieter Paul Rubens, Antoon Van Dyck, and Jacob Jordaens. New cultural, political, and artistic attitudes under the Spanish/ Austrian Habsburgs; atelier practices and connoisseurship problems; prints and drawings; creative methods of research. C-L: Medieval and Renaissance Studies. 3 units. *Van Miegroet*

258-259. Art and Cultural History of Flanders and the Netherlands from the Fifteenth through the Seventeenth Centuries. A contextual interpretation of art and culture of the Greater Netherlands through intensive and immediate contact with the cultural legacy of major cities such as Ghent, Bruges, Leuven, Antwerp, and Brussels in the south, and Haarlem, Leiden, Amsterdam, Delft, and Utrecht in the north. Visits to major museums, cathedrals, the atelier of Rubens; discussion of major painters such as Van Eyck, Bosch, Bruegel, Rembrandt, Hals, Vermeer, Jordeans, and Rubens. (Taught in Flanders and the Netherlands.) 6 units. *Van Miegroet*

261. Nineteenth-Century Art, 1789-1848: Revolution to Revolution. Painting and sculpture of leading artists within the movements of neoclassicism, romanticism, and mid-century realism. 3 units. *Cernuschi*

262. American Art from Colonial Times to 1900. The development of an American national school in portraiture, history painting, landscape, genre scenes, and still-life. Major figures include Copley, Bingham, Cole, Church, Whistler, and Eakins. 3 units. *Powell*

263. Twentieth-Century American Art. Survey of American twentieth-century art from 1900 to the present, including major stylistic and theoretical developments and movements as well as the art of women, and Afro-American, Asian-American, and native American artists. 3 units. *Powell*

266. Nineteenth-Century Art after 1848: The Avant-garde and Modernism. A survey of the second half of the nineteenth century in Europe with particular emphasis on realism, impressionism, post-impressionism, and symbolism. 3 units. *Cernuschi or Stiles*

267. Twentieth-Century Art, 1900-1945. Major artistic movements and theoretical aims of early modernism: fauvism, cubism, expressionism, futurism, constructivism, suprematism, dada, surrealism, deStijl, Bauhaus, and Neue Sachlichkeit. 3 units. *Cernuschi or Stiles*

268. Art since 1945. Major artistic movements and theory in Europe and the United States after World War II: abstract expressionism, color field, pop art, minimal art, Arte Povera, process, conceptual, and performance art, earthworks, photo-realism, neo-expressionism, and appropriation. 3 units. *Cernuschi or Stiles*

269. Modern Sculpture. The development of sculpture from Rodin to the present. Special attention to the transformation of sculpture in the twentieth century by new

materials, methods, and environments. Emphasis on both abstract and figurative works. 3 units. *Cernuschi or Stiles*

272. Topics in Oriental Art. A critical survey of Chinese, Korean, and Japanese art from the earliest times to the nineteenth century. 3 units. *Lee*

273. Art, Architecture, and Masquerade in Africa. Major art forms, monuments, vernacular structures, and masking traditions in West, Central, and Southern Africa. From ancient times to the present. 3 units. *Powell*

274. Art and Philosophy from West Africa to the Black Americas. A survey of several major cultural groups in West Africa and their impact on the arts and religions of blacks in South America, the Caribbean, and the United States. 3 units. *Powell*

275. Art and Material Culture of the Southern United States. A survey of art that was created in the southern United States and made by artists from the South. Special attention given to material culture, vernacular art forms, site-specific creations, and work that addresses the idea of a regional identity. 3 units. *Powell*

276. The Blues Aesthetic: Afro-American Art in the Twentieth Century. Art of the twentieth century, with an emphasis on works derived from an Afro-United States cultural perspective. Major figures include Aaron Douglas, Jacob Lawrence, Charles White, Elizabeth Catlett, and Romare Bearden. 3 units. *Powell*

277. The History of Conceptual Art. Works in the visual arts in which the primary means and medium of expression is language and systems: symbolic, natural, social, cultural, and political structures and institutions. Theoretical discussion focusing on the dematerialized art object and on the materialized art idea. 3 units. *Stiles*

278. Pre-Columbian Art and Architecture. A survey of the art and architecture of American cultures in Mexico, Central America, and Peru before the Spanish conquest. Particular emphasis on their political and religious functions, including the Olmec, Teotihuacan, Maya, Aztec, and Inca civilizations. 3 units. *Reents-Budet*

279. The History of Performance Art. Works in the visual arts in which the primary means and medium of expression is the human body in happenings, Fluxus, demonstrations, destruction art, body art, and performance since 1955. Theoretical discussion focusing on the challenge that live art poses to the traditional paradigm of the art object. 3 units. *Stiles*

280. The Interpretation of Abstraction. Different manifestations and philosophies of abstract art from their early philosophical roots in the late nineteenth century (Pater, Schopenhauer, Nietzsche) to twentieth-century formulations of modernism (Shapiro, Greenberg). Emphasis on the work of Picasso, Kandinsky, Malevich, Mondrian, Pollock, Rothko, Newman, Stella, Reinhardt, and Morris. 3 units. *Cernuschi*

281. The New York School: Art of the 1940s and 1950s. American art after World War II: abstract expressionism and the New York School. Emphasis on gestural painting (Pollock, de Kooning, Kline) and color field (Rothko, Newman, Gottlieb) with particular attention to issues of criticism and interpretation. 3 units. *Cernuschi*

282. The Concept of Expressionism. Expressionism in modern art with emphasis on early twentieth-century examples in Scandinavia, Austria, and Germany, abstract expressionism in New York, and recent manifestations of neo-expressionism associated with the postmodern. Emphasis on Munch, Schiele, Kirchner, Nolde, Pollock, de Kooning, Schnabel, Rainer, Baselitz, and Kiefer. 3 units. *Cernuschi*

284. History of Impressionism. The evolution of the impressionist movement and post-impressionist reactions of the 1880s. Particular attention to the work of Manet, Degas, Monet, Renoir, and Pissarro. 3 units. *Cernuschi*

285. Post-Impressionism. The emergence and development of post-impressionist styles—neo-impressionism, synthetism, symbolism—with emphasis on Seurat, Cézanne, Van Gogh, and Gauguin. The impact of post-impressionism on early twentieth-century movements, including fauvism, expressionism, and cubism. 3 units. *Stiles*

286. Feminism in Twentieth-Century Art. A study of the contributions of women artists to the formal and theoretical discourses of modern art with particular attention to issues of feminism. C-L: Women's Studies. 3 units. *Stiles*

287. Surrealism. The origins, aims, literature, and politics of the international movement of surrealism, which flourished between the world wars, examined in the context of surrealist theory. The psychoanalytic and metaphysical sources of surrealist poetry and visual representations as reflecting a utopian ideology of liberation. 3 units. *Stiles*

288. Twentieth-Century Modernist and Postmodernist Criticism. A survey of the writings of artists, critics, and art historians from the late nineteenth century to the present, concentrating on major critical debates and on the interplay of various methodologies including formalist, iconographic, Marxist, feminist, psychoanalytic, structuralist, and poststructuralist in the interpretation of twentieth-century art. 3 units. *Cernuschi or Stiles*

289. Modern Architecture. The history of architecture from nineteenth-century Beaux-Arts classicism through Art Nouveau and the modern movement to postmodernism. Political and ideological as well as the formal and technical aspects of building investigated through primary texts. 3 units. *Wharton*

290. The Human Figure in Modernist and Postmodernist Art. An analysis of the role of figuration in twentieth-century painting, sculpture, and experimental art with emphasis on the ideological debate between modernists and postmodernists on the signification and interpretation of representational figuration. 3 units. *Stiles*

293. Art and Culture of Mesoamerica. The art of pre-Columbian Mesoamerica (Mexico, Guatemala, Belize, and Honduras) from the beginnings of permanent settlements through the coming of the Spaniards (2000 B.C.-1519 A.D.). The Olmec, Teotihuacan, Zapotec, Maya, Mixtec, and Aztec cultures, including the numerous indigenous writing systems, studied in order to understand sociopolitical and religious institutions. 3 units. *Reents-Budet*

391, 392. Individual Research in Art History. Directed research and writing in areas unrepresented by regular course offerings. Consent of instructor required. 3 units each. *Staff*

393. Colloquium in the History of Art. Topics of interest to art historians in every field, including "The Question of Originality," "Implications of the Frame (or its absence)," and "Art and Economy: The Impact of the Market on Visual Production." Faculty and students participate in the forum. Consent of instructor required. 3 units. *Staff*

394. Graduate Symposium. Graduate students deliver major research papers to their peers, faculty, and interested visitors. A one-day event organized by participating graduate students, supervised by a student-faculty committee, and scheduled annually sometime in April. Consent of instructor required. 3 units. *Staff*

COURSES CURRENTLY UNSCHEDULED

206S. Roman Architecture

264S. Topics in Romanticism

Asian and African Languages and Literature

Associate Professor Cooke, *Director*

Courses in the following languages are taught currently and regularly in Asian and African Languages and Literature: Arabic, Chinese, modern Hebrew, Hindi-Urdu, Japanese, and Swahili. In addition, courses in Korean and Persian are taught on an irregular basis. Some of the literature courses are taught in English translation.

For a detailed listing of course offerings, see the Asian and African Languages and Literature section in the *Bulletin of Duke University: Undergraduate Instruction*.

ASIAN AND AFRICAN LANGUAGES AND LITERATURE

299. Asian and African Languages and Literature. Graduate credit for a course in any of the following languages: Arabic, Chinese, Hebrew, Hindi, Japanese, Korean, Persian, Swahili. 3 units. *Staff*

HINDI-URDU

Courses Currently Unscheduled

200, 201. Special Studies in South Asian Languages

Biochemistry

Professor Hill, *Chair* (255 Nanaline H. Duke); Associate Professor Hsieh, *Director of Graduate Studies* (134 Nanaline H. Duke); Professors Bell, Bennett, Blackshear, Fridovich, Greenleaf, Kredich, Lefkowitz, Modrich, Rajagopalan, D. Richardson, J. Richardson, Siegel, Spicer, Steege, and Webster; Associate Professors Greene, B. Kaufman, and Sage; Assistant Professors Been, Beese, Casey, Fierke, Garrett, Hellinga, Hershfield, R. Kaufman, Oas, and Parker; Professors Emeriti Bernheim, Gross, Guild, and McCarty

Graduate work in the Department of Biochemistry is offered leading to the Ph.D. degree. Preparation for such graduate study may take diverse forms. Undergraduate majors in chemistry, biology, mathematics, or physics are welcome, but adequate preparation in chemistry is essential. Graduate specialization areas include protein structure and function, crystallography and NMR of macromolecules, nucleic acid structure and function, lipid biochemistry, membrane structure and function, molecular genetics, and enzyme mechanisms. The biochemistry department, in cooperation with the University Programs in Genetics and in Cell and Molecular Biology, offers biochemistry students the opportunity to pursue advanced research and study to fulfill the requirements for the Ph.D. degree related to these fields.

200. General Biochemistry. An introductory survey of fundamental aspects of biochemistry with emphasis on the structure of macromolecules, mechanism of enzyme action, metabolic pathways, biochemical genetics, and the structure and functions of special tissues. Designed for medical students; graduate students only with consent of instructor. 4 units. *Staff*

209, 210. Independent Study. A tutorial designed for students who are interested in either a laboratory or a library project in biochemistry. Credit to be arranged. C-L: Marine Sciences. Variable credit. *Staff*

215. Genetic Mechanisms. Genetic mechanisms in molecular terms emphasizing gene function, segregation, and regulation in prokaryotes and eukaryotes. Systems covered include bacterial viruses, bacteria, plasmids, cellular organelles, and selected lower and higher eukaryotes. Course material will be drawn from original literature. Prerequisite: introductory biochemistry. C-L: The University Program in Genetics. 3 units. *Webster and staff*

219. Molecular and Cellular Bases of Differentiation. See C-L: Cell Biology 219; also C-L: Immunology 219, Microbiology 219, and Pathology 219. 3 units. *Counce and staff*

222. Structure of Biological Macromolecules. Introduction to the techniques of structure determination by X-ray crystallography and study of some biological macromolecules whose three-dimensional structures have been determined at high resolution. 2 units. *Richardson*

224. Biochemistry of Development and Differentiation. An extension of topics covered in the first semester course, Biochemistry 219. Emphasis on the control of transcription and translation of messenger RNA in mammalian cells. Studies include gene amplification, postsynthetic modifications of chromosomal proteins, as a result of hormone induction. Specific systems will include the development of the mammary gland, the pancreas, and the chick oviduct. 2 units. *McCarty*

227. Introductory Biochemistry I. Chemistry of the constituents of proteins, lipids, carbohydrates, and nucleic acids and their metabolic interrelationships. Prerequisite: organic chemistry. 3 units. *Hill and staff*

228. Introductory Biochemistry II. Structure, function, and biosynthesis of biological macromolecules and regulation of their synthesis. Intermediary metabolism and metabolic utilization of energy. Biochemistry of biological membranes, receptors, and signal transduction via membrane receptors. Prerequisites: organic chemistry and Biochemistry 227. 3 units. *Webster and staff*

232. Extracellular Matrix and Cell Adhesion. See C-L: Cell Biology 232. 2 units. *Bennett and Erickson*

259. Molecular Biology I: Proteins and Enzymes. Prerequisite: introductory biochemistry or consent of instructor. See C-L: Cell and Molecular Biology 259; also C-L: Cell Biology 259, Immunology 259, and Microbiology 259. 3 units. *Richardson and staff*

265S, 266S. Seminar. Topics and instructors announced each semester. 2 units or variable. Variable credit. *Staff*

268. Molecular Biology II: Nucleic Acids. Biochemistry of nucleic acids, with emphasis on their chemistry, structure, metabolism, and biological function in information transfer. Prerequisites: introductory biochemistry and BCH/CMB/CBI/IMM/MIC 259, or consent of instructor. C-L: Cell and Molecular Biology 268, Cell Biology 268, Immunology 268, Microbiology 268, and The University Program in Genetics. 4 units. *Steege and staff*

288. The Carbohydrates and Lipids of Biological Systems. The subjects will be considered in the following two general categories: (a) the relationship between chemical structure and biological function, and (b) biosynthesis and catabolism. 2 units. *Kaufman*

291. Physical Biochemistry. Basic principles of physical chemistry as applied to biological systems. Topics include thermodynamics, kinetics, statistical mechanics, spectroscopy, and diffraction theory. Concepts discussed in the context of the biochemistry and behavior of biological macromolecules. Emphasis on quantitative understanding of biochemical phenomena, with extensive problem solving as an instructive tool. Prerequisites: undergraduate physical chemistry and one year of calculus. 3 units. *Oas and staff*

320. Cell Differentiation in Development and Disease. Introduction to the organization of the eukaryotic genome provided by recent technical advances in genetics and the use of recombinant DNA probes. Consideration of chromosome activation, gene

amplification, and the impact of nucleocytoplasmic interactions on the regulation of differentiation. Transition phases of cell cycle discussed in regard to normal and oncogene function. Conferences devoted to specific examples dealing with critical aspects of differentiation in development of normal and disease states. 2 units. *Counce, Kaufman, and McCarty*

321. Hormone and Tissue Interactions in Differentiation and Disease. Hormones and other biochemical signals in regulation of the differentiated state including amino acids, polypeptide and steroid hormone response in insects, snails, and higher vertebrates discussed in terms of biotechnology used to elucidate mechanisms of information transfer and gene control at the chromatin level. Cell-cell, cell-matrix, and hormonal interactions considered as control elements in development and differentiation. Interactions involving cell surface, basal lamina, and extracellular matrix discussed in terms of differentiation of limb bud/pancreas/lymphocyte/and neural tissue. Conferences include hormone control of sex differentiation, ectopic hormone biosynthesis, and endocrine related diseases. 2 units. *Kaufman and K. McCarty, Sr.*

345, 346. Biochemistry Seminar. Required of all biochemistry students. 1 unit each. *Oas*

417. Cellular Signaling. See C-L: Cell Biology 417; also C-L: Pharmacology 417. 3 units. *Bell, Caron, Casey, Means, and invited lecturers*

COURSES CURRENTLY UNSCHEDULED

245L. Macromolecules, Ecology, and Evolution

276. Comparative and Evolutionary Biochemistry

286. Current Topics in Immunology

296. Biological Oxidations

297. Intermediary Metabolism

299. Nutrition

Biological Anthropology and Anatomy

Professor Kay, *Chair* (267 Sands); Assistant Professor White, *Director of Graduate Studies* (Wheeler Building); Professors Cartmill, Glander, Hylander, Simons, and Terborgh; Associate Professors Roth, Smith, and Van Schaik; Assistant Professors Bassett, Maas, and Pope; Professor Emeritus LaBarre; Associate Professor Emeritus Duke; Adjunct Associate Professor Wright

Students will be accepted for the Ph.D. degree. Admission to the program is not contingent on any particular course of study at the undergraduate level. The goal of the graduate program in biological anthropology and anatomy is to provide students with a broad-based background in organismal biology with which to study the behavior, ecology, and evolution of primates. The three general areas of specialization in the department are: (1) behavior, ecology, and genetics; (2) paleontology, systematics, and evolution; and (3) functional, comparative, and developmental morphology. Students are encouraged to define a course of study that crosses these boundaries and that extends beyond the strict limits of primatology. Research opportunities include behavioral research at the Duke University Primate Center; ecological and behavioral fieldwork in Africa, South America, Asia, and Madagascar; paleontological fieldwork in Africa, South America, North America, and Madagascar; and laboratories in experimental functional morphology and comparative embryology.

Courses of study are tailored to meet individual needs, but all students will be expected to take gross human anatomy, a course in statistics and experimental design, and at least one course in each of the subfields of the department. Students are required to demonstrate a reading knowledge of at least one language other than English. Further details are available in the *Guide to the Graduate Program in Biological Anthropology and Anatomy*, available from the director of graduate studies.

238. Functional and Evolutionary Morphology of Primates. History and functional significance of locomotor and feeding adaptations, craniofacial morphology, sense organs, and reproductive systems in primates, including *Homo sapiens*. Consent of instructor required. 3 units. *Cartmill and Kay*

244L, S. Comparative Primate Ecology. Comparisons of the evolutionary ecology of prosimians, monkeys, and apes. With field methods. Prerequisites: Biological Anthropology and Anatomy 93 and 143 recommended. 3 units. *Glander or White*

245S. Primate Social Evolution. Ecological determinants of, and biological constraints on, social strategies and systems. Emphasis on primates. Prerequisites: Biological Anthropology and Anatomy 93; 143, 144L, or 146; or consent of instructor. 3 units. *Van Schaik*

246S. The Primate Fossil Record. Evolution of humans and other primates as inferred from fossil remains. Prerequisite: a course in human evolution. 3 units. *Simons*

247. The Hominid Fossil Record. Origin and successive stages of development of human ancestors. Detailed analysis of adaptive types and cultural developments. Personalities and current controversies in the study of hominid paleontology. Prerequisites: Biological Anthropology and Anatomy 93, 132, or consent of instructor. 3 units. *Simons*

248S. Evolution of Mammals. The origin, adaptive radiation, and phylogenetic relationships of mammals, as inferred from the fossil record. Consent of instructor required. 3 units. *Maas*

250. Biometry. A practically oriented overview of the statistical analysis of biological data. Topics include data collection and experimental design, methods and techniques of data organization, use of computing programs and packages, applications of appropriate parametric and nonparametric statistical techniques, assumptions and problems encountered with biological data analysis, and interpretation of results. Prerequisite: Mathematics 136, Psychology 117, Sociology 133, Statistics 10D, 110, 112, 114, 213, or equivalent. C-L: Environment 253. 3 units. *Gerhart and White*

280S, 281S. Seminar in Selected Topics. Special topics in methodology, theory, or area. Consent of instructor required. 3 units each. *Staff*

287S. Macroevolution. Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisites: Biology 21L and 22L or equivalents. C-L: Botany 287S and Zoology 287S. 3 units. *Mishler and Roth*

290. Pattern and Process in Vertebrate Development. Research results on developmental processes applied to classic problems of comparative vertebrate biology. Specific focus to vary, but to include cell differentiation and migration, induction, cell-cell interaction and cell mechanics as well as craniofacial morphogenesis, development and evolution, developmental constraints and comparative embryology. Prerequisites: course in comparative or human anatomy and consent of instructor. C-L: Zoology 290. 3 units. *Smith*

292S. Topics in Morphology and Evolution. Various aspects of vertebrate morphology and evolution, including major historical approaches to the interpretation of morphology; the evolution, development, and function of specific morphological structures; and patterns of vertebrate evolution. Consent of instructor required. 3 units. *Smith*

301. Anatomy of the Limbs. The musculoskeletal anatomy of the limbs and limb girdles. Emphasis is on detailed dissection of the extremities, with a minor focus on clinical applications. Course primarily intended for advanced graduate students in physical therapy. Consent of instructor required. 1 to 3 units. Variable credit. *Staff*

305. Gross Human Anatomy. Includes complete dissection of a cadaver; laboratory work is supplemented by conferences which emphasize biological and evolutionary aspects. Required of entering graduate students in anatomy; by arrangement, may extend into second semester. Prerequisites: adequate background in biology, including comparative anatomy and embryology and written consent of instructor. 3 units. *Staff*

312. Research. Individual investigations in the various fields of biological anthropology and anatomy. Consent of instructor required. Credit to be arranged; maximum 6 units. Variable credit. *Staff*

313. Anatomy Seminar. Regular meeting of graduate students and staff in which current research problems in anatomy will be presented. 1 unit. *Staff*

314. Biological Anthropology Seminar. Regular meeting of graduate students and staff in which current research problems in biological anthropology will be presented. 1 unit. *Staff*

334. Topics in Physical Anthropology. 3 units. *Staff*

340. Tutorial in Advanced Anatomy. Topics for intensive reading and discussion will be chosen according to the student's interests, related to basic problems in function of bone and muscle systems, development and differentiation, comparative anatomy at the gross and histological level and vertebrate evolution. Consent of instructor required. Variable credit. *Staff*

354. Research in Biological Anthropology and Anatomy. A preceptorial course in various research methods in biological anthropology and anatomy. Consent of instructor required. Credit to be arranged. Variable credit. *Staff*

393. Independent Study. Directed reading and research. Consent of instructor required. 3 units. *Staff*

COURSES CURRENTLY UNSCHEDULED

293, 294. Evolutionary Theory

Botany

Professor Searles, *Chair* (149 Biological Sciences); Professor Strain, *Director of Graduate Studies* (134 Biological Sciences); Professors Antonovics, Barber, Boynton, Christensen, W. Culberson, Ramus, Reynolds, Schlesinger, Siedow, Stone, Terborgh, White, and Wilbur; Associate Professors Knoerr, Mishler, and Vilgalys; Assistant Professors Baldwin, Clark, Dong, Kohorn, and Sun; Professors Emeriti Anderson, Billings, Hellmers, Kramer, Naylor, and Philpott; Research Professors C. Culberson and Patterson; Associate Research Professor Harris; Adjunct Professor Osmond; Adjunct Associate Professors Funk, Kress, Lacey, Wagner, and Zimmer; Adjunct Assistant Professor McDade

Graduate work in the Department of Botany is offered leading to the A.M. (nonthesis), M.S. (thesis), and Ph.D. degrees. Students entering the graduate program in botany normally have a broad background in the botanical or biological sciences supplemented

with basic courses in chemistry, mathematics, and physics. Biochemistry and physical chemistry are strongly recommended for students interested in molecular areas, and advanced courses in mathematics are recommended for students in population genetics and ecology. Deficiencies may be corrected by taking appropriate courses during the first year of graduate study.

Students in botany may specialize in a wide variety of areas including anatomy; cellular and molecular biology; evolution; developmental, ecological, molecular, organ-elle, and population genetics; physiology; community, ecosystem, physiological, and population ecology; marine biology; and the systematics of algae, fungi, lichens, bryophytes, ferns, and flowering plants. Students' programs are tailored to individual needs. A brochure providing detailed information on the botany department is available from the director of graduate studies.

209L. Lichenology. Morphology, systematics, and biological and ecological implications of the lichens. Collection and identification of specimens and the use of lichen chemistry in taxonomy. 3 units. C. Culberson and W. Culberson

210L. Bryology. Morphological, systematic, and ecological characteristics of mosses and liverworts. 3 units. Mishler

212L, S. Phycology. Morphological and ecological characteristics of common freshwater and marine algae and principles of their classification. 3 units. Searles

215. Tropical Ecology. Ecosystem, community, and population ecology of tropical plants and animals with application to conservation and sustainable development. Prerequisite: a course in general ecology. C-L: Environment 217 and Zoology 215. 3 units. Terborgh

217L. Biology of Marine Macrophytes. Physiology and ecology of seaweeds, seagrasses, marshgrasses, and mangroves. Biological flux of carbon and nutrients in coastal seas. Ecological consequences of photosynthetic adaptations. (Given at Beaufort.) Prerequisites: Biology 21L and 22L; and Chemistry 11L, 12L or equivalent. C-L: Marine Sciences. 4 units. Ramus

218L. Barrier Island Ecology. An integration of barrier island plant and animal ecology within the context of geomorphological change and human disturbance. Topics include: barrier island formation and migration, plant and animal adaptations, species interactions, dune succession, maritime forests, salt marshes, sea level rise, conservation policy, and restoration ecology. Field trips to many of the major North Carolina barrier islands. Strong emphasis on field observation and independent research. (Given at Beaufort.) Prerequisite: introductory biology; suggested: course in botany or ecology. C-L: Environment 218L and Marine Sciences. 6 units. Evans, Peterson, and Wells (visiting summer faculty)

219L. Benthic Marine Algae. Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and fieldwork in ocean and estuaries. (Given at Beaufort.) Prerequisite: introductory biology; plant diversity recommended. C-L: Environment 296L and Marine Sciences. 4 units. Schneider (visiting summer faculty)

220L. Mycology. Survey of the major groups of fungi with emphasis on life history and systematics. Field and laboratory exercises. 3 units. Vilgalys

224T, 225T. Special Problems. Students with adequate training may do special work in the fields listed below. Credit to be arranged. 1 to 4 units. Variable credit.

2. Genetics. Antonovics
3. Genetics. Boynton
4. Ecology. Christensen
5. Ecology. Clark

6. Lichenology. *W. Culberson*
13. Cell Biology. *Kohorn*
18. Bryology and Systematics. *Mishler*
24. Phycology. *Ramus*
29. Ecology. *Schlesinger*
30. Phycology. *Searles*
31. Physiology. *Siedow*
33. Systematics of Flowering Plants. *Stone*
34. Ecology. *Strain*
38. Mycology and Molecular Systematics. *Vilgalys*
42. Anatomy and Morphology of Vascular Plants. *White*
44. Systematics of Vascular Plants. *Wilbur*
53. Tropical Ecology and Conservation. *Terborgh*
54. Marine Ecology. *Barber*
55. Ecology. *Reynolds*
57. Systematic Botany. *Baldwin*
58. Plant Molecular Biology. *Dong*
60. Plant Molecular Biology. *Sun*

229L. Paleocology. Global change over the last two million years. Prerequisites: two semesters of biology or geology; and one semester each of calculus, chemistry, and physics; or consent of instructors. C-L: Zoology 229L. 4 units. *Bush, Clark, and Livingstone*

232. Microclimatology. See C-L: Environment 232. 3 units. *Knoerr*

234S. Problems in the Philosophy of Biology. Consent of instructor required. See C-L: Philosophy 234S; also C-L: Zoology 234S. 3 units. *Brandon (philosophy)*

237L. Systematic Biology. Theory and practice of identification, species discovery, phylogeny reconstruction, classification, and nomenclature. Prerequisites: Biology 21L and 22L or equivalents. C-L: Zoology 237L. 3 units. *Mishler*

240L. Plant Diversity. Major groups of the living plants; their evolutionary origins and phylogenetic relationships. Prerequisite: introductory biology. 3 units. *Mishler, Searles, or Wilbur*

241. Field Botany. Identification and recognition of the vascular flora of the Carolinas. Frequent field trips to representative habitats. Prerequisite: introductory plant identification course or consent of instructor. 3 units. *R. Wilbur*

242L. Systematics. Principles of vascular plant taxonomy, with practice in identification of the local flora. Lectures, laboratories, and field trips. Prerequisite: one year of biology. 3 units. *R. Wilbur*

243L. Evolution and Classification of Angiosperms. Characteristics and phylogenetic relationships of major flowering plant lineages. Emphasis on current literature, rigorous methods, modern controversies, and biological and biogeographic implications of relationships. Prerequisite: Biology 142L or equivalent. 3 units. *Baldwin, Funk, Kress, and Wagner*

252. Plant Physiology. Principal physiological processes of plants, including respiration, photosynthesis, water relations, and factors associated with plant morphogenesis. Prerequisites: introductory college biology and one year of chemistry; organic chemistry is desirable. 3 units. *Siedow*

257L. Molecular Systematics and Evolution. Descriptive and experimental procedures used to assess evolutionary diversity for analysis of population genetics and systematic relationships. Laboratory problems, discussion, and individual research projects. Prerequisites: basic course work in systematics, evolution, and genetics. 3 units. *Vilgalys*

261. Photosynthesis. Principles of photosynthesis: developmental, mechanistic, regulatory, and ecological aspects of the photosynthetic process. Prerequisite: Biology 152 or Botany 252 or equivalent. 3 units. *Siedow*

265L. Physiological Plant Ecology. The physiological approach to interpreting adaptation in plants, with emphasis on terrestrial seed plants. Prerequisites: Biology 110L and 152 or equivalents. 3 units. *Strain*

267L. Community Ecology. Mechanisms that determine the distribution and abundance of plants and animals: geology, climate, physiography, soils, competition, predation, and history. Lectures focus on ecological principles. Seminars and weekend field trips. Prerequisites: an introductory ecology course and consent of instructor. C-L: Zoology 267L. 3 units. *Christensen*

269. Advanced Cell Biology. Prerequisite: introductory cell biology or consent of instructor. See C-L: Zoology 269; also C-L: Cell and Molecular Biology 269, Cell Biology 269, Immunology 269, and Microbiology 269. 3 units. *Nicklas (zoology) and staff*

272. Biogeochemistry. Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and surficial processes. Prerequisite: Chemistry 12L or equivalent. C-L: Geology 272. 3 units. *Schlesinger*

280. Principles of Genetics. Structure and properties of genes and chromosomes in individual organisms and in populations. Prerequisite: introductory biology. C-L: The University Program in Genetics and Zoology 280. 3 units. *Antonovics, Boynton, Gillham (zoology), and Laurie (zoology)*

283. Molecular Genetics of Organelles. Genetics, biochemistry, and molecular biology of the organelles of eukaryotic cells, and cellular symbionts. Emphasis on recent literature. Prerequisite: introductory genetics. C-L: The University Program in Genetics and Zoology 283. 3 units. *Boynton and Gillham (zoology)*

285S. Ecological Genetics. Interaction of genetics and ecology and its importance in explaining the evolution, diversity, and distribution of plants and animals. Prerequisites: Biology 180 and Botany 286 or equivalents. C-L: The University Program in Genetics. 3 units. *Antonovics*

286. Evolutionary Mechanisms. Population ecology and population genetics of plants and animals. Fitness concepts, life history evolution, mating systems, genetic divergence, and causes and maintenance of genetic diversity. Prerequisites: Biology 21L and 22L; and Biology 180 or equivalents. C-L: The University Program in Genetics and Zoology 286. 3 units. *Antonovics and Uyenoymama (zoology)*

287S. Macroevolution. Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisites: Biology 21L and 22L or equivalents. C-L: Biological Anthropology and Anatomy 287S and Zoology 287S. 3 units. *Mishler and Roth (zoology)*

295S, 296S. Seminar. Credit to be arranged. Variable credit. *Staff*

300. Tropical Biology: An Ecological Approach. Highly intensive, field-oriented course conducted in Costa Rica under auspices of the Organization for Tropical Studies. For additional information refer to the chapter "Special and Cooperative Programs." 6 to 8 units. Variable credit. *Staff*

305S, 306S. Plant Systematics Seminar. Weekly presentation of current research in plant systematics by students, faculty, and invited speakers. 1 unit each. *Vilgalys*

310S, 311S. Plant Ecology Seminar. Discussion of current research and literature. 1 unit each. *Staff*

315S, 316S. Population Genetics Seminar. Discussion of recent developments in population genetics. Topics include population dynamics, forces affecting gene frequency change, molecular evolution, philosophy of evolutionary biology. Student presentations are integral to the course. 1 unit each. *Antonovics*

320S, 321S. Systematics Discussion Group. An informal discussion group. Topics vary from semester to semester; cover systematic and evolutionary biology in the broad sense. 1 unit each. *Staff*

325S, 326S. Developmental, Cellular, and Molecular Biology Seminar. Weekly presentations in developmental, cellular, and molecular biology topics by students, faculty, and invited speakers. Consent of instructor required. 1 unit each. *Staff*

330L. Environmental Monitoring and Instrumentation. Methods of measuring and monitoring the earth's physical environment with emphasis on water and air resources. Characteristics and uses of contemporary sensors, measurement and data acquisition systems. Methods of obtaining and processing computer compatible data records. Includes laboratory. Offered on demand. C-L: Environment 330L. 4 units. *Knoerr*

359, 360. Research in Botany. Individual investigation in the various fields of botany. Credit to be arranged. C-L: Marine Sciences. Variable credit. *All members of the graduate staff*

COURSES CURRENTLY UNSCHEDULED

221S. Topics in Advanced Mycology

247L. Plant Ecology

256L, S. Plant Biosystematics

344. Micrometeorology and Biometeorology Seminar

RELATED PROGRAMS

The University Program in Cell and Molecular Biology. Cell and molecular biology courses offered by the botany department are an integral part of this interdepartmental program. Refer to the announcement in this bulletin under Cell and Molecular Biology for descriptions of the following courses: 259. Molecular Biology I: Proteins and Enzymes, and 264. Cell and Molecular Biology Seminar.

The University Program in Genetics. Genetics courses offered by the botany department are an integral part of this interdepartmental program. Refer to the announcement in this bulletin under the University Program in Genetics for more information.

The University Program in Marine Sciences. Interdisciplinary programs emphasizing marine botany are available. Refer to the section on the University Program in Marine Sciences.

Program in Integrative Biology. This interdisciplinary program provides selected graduate students with an academic and research environment in which they are encouraged to think broadly and synthetically about problems in biology.

Program in Tropical Biology. Fellowships are available for travel and subsistence in field-oriented programs in Central America. Refer to the section on Organization for Tropical Studies in the chapter "Special and Cooperative Programs."

Business Administration

Professor Keller, *Chair* (219W Fuqua School of Business); Professor Bettman, *Director of Graduate Studies* (429E Fuqua School of Business); Professors R. Ashton, Baligh, Burton, Fischer, Forsyth, Laughhunn, Lewin, Magat, Payne, Staelin, Whaley, and Winkler; Associate Professors A. Ashton, Boulding, Daniels, Edell, Foster, Harvey, Hsieh, Huber, Kouvelis, Linville, Mazzola, McCann, McCardle, M. Moore, M. C. Moore, Nau, Purohit, Rummel, Sheppard, T. Smith, and Viswanathan; Assistant Professors Anton, Bansal, Beneish, Delgado, Deneffe, Haveman, Johnson, Maines, Muthuswamy, Nandakumar, Ndilikiliksha, Salk, J. Smith, Sondak, Swenson, and Wallace; Professor Emeritus Cohen; Research Professor Breeden

The Ph.D. in Business Administration program prepares candidates for research and teaching careers at leading educational institutions and for careers in business and governmental organizations where advanced research and analytical capabilities are required. The Ph.D. program places major emphasis on independent inquiry, on the development of competence in research methodology, and on the communication of research results.

The student and his/her faculty committee determine the specific program of study. Each student takes a comprehensive examination at the end of the second year or at the beginning of the third year of residence. The final requirement is the presentation of a dissertation. The Ph.D. program usually requires four years of work. Refer to the *Bulletin of Duke University: The Fuqua School of Business* for a complete list of courses and course descriptions.

510. Bayesian Inference and Decision. Methods of Bayesian inference and statistical decision theory, with emphasis on the general approach of modeling inferential and decision-making problems as well as the development of specific procedures for certain classes of problems. Topics include subjective probability, Bayesian inference and prediction, natural-conjugate families of distributions, Bayesian analysis for various processes, Bayesian estimation and hypothesis testing, comparisons with classical methods, decision-making criteria, utility theory, value of information, and sequential decision making. C-L: Statistics 221. 3 units. *Winkler*

513. Choice Theory. This seminar deals with the topics of measurement theory, conjoint measurement, expected utility and subjective expected utility theory, multi-attribute utility theory and recent advances in preference modeling (generalized non-linear utility theories). The goal of this seminar is to equip students with tools so that they can use preference modeling in a wide variety of social science applications. C-L: Statistics 234. 3 units. *Staff*

521. Organization Seminar: A Micro Focus. Individual and small group behavior in organizations. Theories of motivation, decision making, interpersonal behavior, group processes, and leadership. A variety of research approaches and methods includes presentation of behavioral research by members of the Fuqua School of Business and other researchers. 3 units. *Staff*

522. Organization Seminar: A Macro Focus. The organization and the subunits which make up the organization. Theories of organization, structure, decentralization, divisionalization, functional area integration, task design, incentives and rewards, information systems, and decision rules are developed with an orientation toward their choice and design for high performance. Includes presentation of research by members of the Fuqua School of Business and other researchers. 3 units. *Staff*

525. Behavioral Decision Theory. Examines the development of research in individual and group decision behavior. Major emphasis is given to theoretical developments and empirical research, with a range of articles assigned for each topic. The basic

topic areas include (1) decision problem structuring, (2) thinking about uncertainties, (3) risk taking, (4) dealing with conflicting values, and (5) combining individual judgments into a group decision. C-L: Psychology: Experimental 316, Psychology: Social and Health Sciences 316, and Statistics 231. 3 units. *Payne*

531. Financial Accounting Seminar. The nature of published financial statement information and its relationship with various economic variables. The list of related variables might include stock market data, bankruptcy filings, and the actions of various users of financial statement information, including management, investors, creditors, and regulators. The focus is on the current research methodologies and research efforts used to analyze the above relationships. A background in masters-level accounting and finance is assumed. 3 units. *Staff*

532. Management Accounting Seminar. Information systems and their use in facilitating management decision making and organizational control. Emphasis on the appropriate research methodologies and paradigms including information economics, decision theory, and organizational theory. Topics include budgeting, incentive systems/performance evaluation, variance investigation, and cost allocation. 3 units. *Staff*

551. Corporate Finance Seminar. Introduction to research areas in corporate finance. Emphasis on the research interests of the instructor, and one of the following topics to be explored in depth: capital budgeting, capital structure, mergers and acquisitions, international finance, and cash management. 3 units. *Staff*

552. Investment Seminar. Survey of research in the investment area and exploration in depth of one or more problems in which research is currently active. Emphasis determined by the instructor from one or more of the following areas: valuation of risky securities, capital asset pricing model and extensions, capital market efficiency, portfolio theory, options and warrants, investment management, and futures contracts. 3 units. *Staff*

553. Portfolio Theory and Asset Pricing. This course mathematically derives well-known results in portfolio theory and asset-pricing models in finance. Topics to be covered include: single-period mean-variance efficient portfolios and the CAPM; pareto optimal allocations; multiperiod and continuous-time optimal consumption and portfolio rules; intertemporal asset-pricing model; arbitrage pricing theory; the term structure of interest rates and inflation risk; allocational roles of futures and options; and pricing and hedging results. Basic mathematics background in calculus, statistics, matrix algebra, optimization and dynamic programming is required. 3 units. *Staff*

561. Seminar in Quantitative Research in Marketing. An overview of the quantitative techniques which are important in marketing research. Each model and technique will be examined in considerable detail so as to permit an understanding of its assumptions, structure, and usefulness. Topics covered will include the general data analysis techniques as well as models from advertising, new products, and pricing decisions. 3 units. *Staff*

562. Seminar in Consumer Behavior. Examines the development of research in consumer behavior. Major emphasis is given to theoretical developments and empirical research, with a range of articles assigned for each topic. Topics include motivation and personality, perceptual processes, information search, choice processes, attitudes and persuasion, learning, and influence in consumer choice. C-L: Psychology: Experimental 315 and Psychology: Social and Health Sciences 315. 3 units. *Bettman*

563. Marketing Models Seminar. The primary goals of this seminar are (a) to critically review the most current research in marketing and (b) to gain a better understanding of and ability to build one's own model. After taking this course, students

should be able to understand the assumptions and mathematical development of the current quantitative work in marketing and to use this understanding to develop meaningful extensions. 3 units. *Staelin*

564. Experimental Design and Analysis Seminar. Examines issues in the design and analysis of experiments. Emphasis on analysis of variance (ANOVA), starting with the basic ANOVA model and examining multiple factor designs, blocking designs, nested models, within subject designs, repeated measure designs, and analysis of covariance. 3 units. *Edell*

571. Operations Strategy Seminar. Recent developments in the strategy of operations in both the manufacturing and service sectors. Topics include the focused factory concept, Japanese manufacturing philosophy, technological policy toward new process development and toward new product introduction, vertical integration, choice of capacity and location, industry analysis, and the impact of government regulation. Emphasis on the development of hypotheses about strategic topics and the empirical means by which they can be tested. 3 units. *Staff*

572. Seminar in Operational and Technological Tactics. Current issues in the day-to-day management of manufacturing and service delivery systems. Topics include material requirements planning, capacity requirements planning, quality of work life projects, productivity measurement and enhancement, implementation of new product introductions and production process modifications, quality assurance, production planning and scheduling, and logistics. Concentration on the substance of recent developments, the generation and test of hypotheses about tactical issues, and the applicability of various optimization techniques to the advance of operation tactics. 3 units. *Staff*

591. Selected Topics in Business. Allows the doctoral student the opportunity to study special topics in management on an occasional basis depending on the availability and interests of students and faculty. 3 units. *Staff*

597. Dissertation Research. For students actively pursuing research on their dissertation. Credit to be arranged. Prerequisites: student must have passed the preliminary examination and have the consent of the director of the doctoral program and instructor. Variable credit. *Staff*

598. Independent Study. Allows the doctoral student the opportunity to engage in study or tutorial on special topics on an individual basis under the supervision of a faculty member. Credit to be arranged. Prerequisites: doctoral program standing and consent of the director of the doctoral program and instructor. Variable credit. *Staff*

599. Directed Research. Allows the doctoral student to engage in individual research projects under the supervision of a faculty member. Credit to be arranged. Prerequisites: doctoral program standing and consent of the director of the doctoral program and instructor. Variable credit. *Staff*

The University Program in Cell and Molecular Biology

Program Administration: Professor Hill, *Director* (biochemistry); Associate Professor B. Kaufman, *Associate Director* (biochemistry); Professors Caron (cell biology), Joklik (microbiology), McClay (zoology), Pizzo (pathology), Siedow (botany), and Webster (biochemistry); Associate Professors Kuhn (pharmacology) and Skene (neurobiology); Assistant Professor Doyle (immunology)

Faculty: A complete list of faculty, including research interests, will be made available to prospective students.

crobiology, neurobiology, pathology, pharmacology, and zoology. To effectively utilize this broad spectrum of expertise for the training of promising scientists while still providing a coherent curriculum, the Duke University Program in Cell and Molecular Biology has been established.

During the first year of doctoral study a student will complete the program's three-course sequence presenting current understanding and research activities in cell biology and the molecular biology of nucleic acids, proteins, and membranes. Each student will also choose elective courses in an area of specialization. Research training is stressed throughout the program and dissertation research usually begins by the third semester. Prospective students may apply directly to the Cell and Molecular Biology Program or to one of the nine participating departments. Applicants must have demonstrated, in addition to overall academic excellence, a proficiency in the biological and physical sciences. Applications for admission and fellowship support must be received by January 31, but early applications may receive advanced consideration.

259. Molecular Biology I: Proteins and Enzymes. Detailed concepts of the structure and function of proteins as enzymes and as structural elements of cellular substructures, including: protein primary structure and its determination, patterns of protein folding, mechanisms of enzyme catalysis and regulation, function and formation of multimeric protein assemblies, kinetics of enzyme reactions. Prerequisite: introductory biochemistry or consent of instructor. C-L: Biochemistry 259, Cell Biology 259, Immunology 259, and Microbiology 259. 3 units. *Richardson and staff*

264. Cell and Molecular Biology Seminar. Required of all students. Third- and fourth-year students discuss their dissertation research. 1 unit. *Kaufman*

268. Molecular Biology II: Nucleic Acids. Biochemistry of nucleic acids, with emphasis on their chemistry, structure, metabolism, and biological function in information transfer. Prerequisites: introductory biochemistry and BCH/CMB/CBI/IMM/MIC 259, or consent of instructor. C-L: Biochemistry 268, Cell Biology 268, Immunology 268, Microbiology 268, and The University Program in Genetics. 4 units. *Steege and staff*

269. Advanced Cell Biology. Structural and functional organization of cells and their components with emphasis on current research problems and prospects. Prerequisite: introductory cell biology or consent of designated instructor. C-L: Botany 269, Cell Biology 269, Immunology 269, Microbiology 269, and Zoology 269. 3 units. *Nicklas and staff*

Cell Biology

Professor Sheetz, *Chair*; Professor Erickson, *Director of Graduate Studies*; Professors Blum, C. Bonaventura, J. Bonaventura, Caron, Counce, Gutknecht, Hatchell, Jöbsis, Johnson, Lieberman, Mandel, McIntosh, McManus, Nicklas, Padilla, Plonsey, Reedy, Robertson, Somjen, Sommer, Spach, and I. Taylor; Associate Professors Akwari, N. Anderson, Bennett, Cobb, Corless, Greenfield, Kiehart, Mills, Schachat, Schomberg, and Vigna; Assistant Professors P. Anderson, Argon, Benjamin, Chappell, Cohn, Davis, DeLozanne, Dittman, Drezner, Freemark, Garrett, Hannun, Iglehart, Kraus, LeFurgey, Lightner, Meyer, O'Brien, O'Halloran, Saling, Swenson, Titus, Wenstrup, and Yarger; Professor Emeritus Moses; Associate Medical Research Professors Aitken and K. Taylor; Assistant Medical Research Professors Chang, Gettys, Klitzman, Lobaugh, Miller, Van Beneden, and White; Adjunct Professor Rodbell

The Department of Cell Biology offers graduate training in modern cell biology and physiology leading to the Ph.D. degree.

Specific research interests include: cytoskeleton and cell motility, including both actin and microtubule based motor mechanisms of contraction, vesicle transport and

chromosome movement; cardiac and skeletal muscle, including ultrastructure, physiology, developmental and molecular biology; cell adhesion and biophysics of membrane interactions; extracellular matrix; protein secretion and trafficking mechanisms; transmembrane receptors and molecular mechanisms of signal transduction; cell physiology, metabolism, and membrane transport in brain, kidney, muscle; vertebrate photoreceptors; high resolution electron microscopy and computer image processing.

The department has excellent facilities for light and electron microscopy; computer image processing, analysis and 3-D reconstruction; X-ray diffraction; cell culture and micromanipulation; and modern biochemistry and molecular biology. The Department of Cell Biology also participates in several university-wide interdisciplinary training programs, including genetics, cell and molecular biology, neurobiology, pharmacology, biomedical engineering, and toxicology.

The Division of Physiology, which is centered in the Department of Cell Biology, brings together faculty and students with interests in cellular, organ, and systemic physiology. The program of graduate studies in physiology is organized through this division. For further information, contact the director of graduate studies.

200. Cell and Tissue Biology. Lectures on the structure and function of the cells and tissues of the body. The laboratory provides practical experience with light microscopy studying and analyzing our extensive slide collection of mammalian tissues. Designed for medical students; graduate students may take this course with consent of instructor. Fall. 3 units. *McIntosh and staff*

201. Microscopic Anatomy. Histology of all the major organs of the body. Structure and cell biology at both the light and electron microscope levels. Laboratory sessions are used to study and analyze our extensive slide collection of mammalian tissues with light microscopes. Designed for medical students; graduate students accepted with consent of instructor. Prerequisite: Cell Biology 200. 3 units. *McIntosh and staff*

202. Medical Physiology. Lectures and conferences on cell and organ physiology. Human and medical aspects are stressed in clinical conferences. Computer-based laboratory exercises. Designed for medical students; graduate students only with consent of instructor. Students may take either 202 or 203 and 204, but not both, for credit. Fall. Prerequisite: Cell Biology 200. 4 units. *Somjen and staff*

203. Introduction to Physiology. Modern organ physiology: cellular physiology, the heart and cardiovascular system, the respiratory system, the kidney, the gastrointestinal, endocrine, and nervous systems. Prerequisite: elementary biology. 4 units. *Blum and staff*

204. Cell and Molecular Physiology. Selected aspects illustrating the use of cellular and molecular approaches to the understanding of physiological organ functions. Topics include: molecular basis of contraction and muscle diversity, cell-cell interactions through cell junctions, paracrine or hormonal signals, signal transduction, molecular basis of channel and carrier functions, physiology of transgenic mice. Prerequisite: Cell Biology 203 or cell biology. 3 units. *Mandel and staff*

205. Design and Analysis of Biological Experiments. An introductory-level course for individuals engaged in or planning research projects in life sciences. Emphasis is on developing an adequate background in the fundamentals of probability, statistics, and hypotheses testing, and the application of those principles to commonly encountered research situations. The course will include lectures, hands-on use of the Statistical Analysis System (SAS) computer package for data analysis, and critical evaluation of experimental designs employed in representative studies from the literature. 3 units. *Lobaugh*

208. Cellular Neurobiology. Consent of instructor required. See C-L: Neurobiology 208. 3 units. *Augustine, Kauer, and Reinhart*

210. Independent Study. Directed reading and study in cell biology/physiology. Descriptions of specific areas may be obtained from the Director of Graduate Studies. Consent of Director of Graduate Studies required. 3 to 9 units each. C-L: Marine Sciences. Variable credit. *Staff*

211. Cellular Mechanisms of Injury. Selected topics in mechanisms of injury at the cellular and molecular levels chosen for reading and discussion in a combined lecture/seminar format. Subject matter varies each semester; can be taken more than once. Consent of instructor required. 3 units. *Fridovich, LeFurgey, Lieberman, Mandel, Steenbergen, and guest faculty*

212. Topics in Reproductive Biology. An in-depth, integrative study of male and female reproduction, including (i) hypothalamic, pituitary, and gonadal control mechanisms, (ii) gamete structure and development, (iii) fertilization, and (iv) pregnancy and parturition. Guest lectures will emphasize the interface between basic, veterinary, and medical sciences. Prerequisite: Cell Biology 269 or equivalent. 3 units. *N. Anderson, Saling, Schomberg, or Tyrey*

213. Oxygen and Physiological Function. The sensitive dependence of many physiological functions on cellular oxidative metabolism. The delicate balance between the oxygen toxicity of hyperoxia and the consequences of hypoxia will be explored from organ malfunction to cell death. Prerequisite: an introductory course in physiology or biochemistry or consent of instructor. 2 units. *Jöbsis*

215. Seminar in the Physiology of Disease. Invited staff and guest speakers discuss their research, emphasizing the normal physiology and pathophysiology underlying particular abnormalities or diseases. Organismic, organ, cellular, and molecular levels of organization. 1 unit. *Mandel and guest faculty*

219. Molecular and Cellular Bases of Differentiation. A multidisciplinary approach stressing the molecular, cellular, and genetic processes involved in differentiation in eukaryotes. C-L: Biochemistry 219, Immunology 219, Microbiology 219, and Pathology 219. 3 units. *Counce and staff*

223. Cellular and Integrative Cardiovascular Physiology and Biophysics. Electrical and mechanical properties of the heart at the cellular and organ levels; reflex control of cardiac output; the heart as an endocrine organ; interaction between heart, kidney, and lung; comparative cardiac physiology. Prerequisites: Cell Biology 203 or equivalent and Physics 52L or equivalent; consent of instructor or graduate status. C-L: Biomedical Engineering 223. 3 units. *Benjamin and staff*

232. Extracellular Matrix and Cell Adhesion. Recent research articles will be read and discussed in depth at a two-hour meeting once a week. Instructors will select papers and provide a brief introduction. Students will present papers and lead discussion in a journal club format. Topics covered will include: fibronectin, laminin, tenascin, collagens; integrins and cell-substrate adhesion; cell-cell adhesion molecules. Offered in odd-numbered years. C-L: Biochemistry 232. 2 units. *Bennett and Erickson*

235. Advanced Research Training in Marine Molecular Biology and Biotechnology. Modern molecular biology taught in lectures and laboratory exercises using fish, molluscs, algae, and other marine forms. Topics and techniques include DNA, RNA and protein assays; techniques of gene transfer, amplification and mapping; plasmid isolation; genomic library screening and bacteriological and cell culture techniques. (Given at Beaufort.) Prerequisites: biochemistry and cell biology or equivalent; for undergrad-

uates, consent of instructor required. C-L: Marine Sciences. 4 units. *C. Bonaventura and staff*

235L. Advanced Research Training in Marine Molecular Biology and Biotechnology. Same as 235 with laboratory. C-L: Marine Sciences. 6 units. *C. Bonaventura and staff*

236S. Seminar on the Cellular and Molecular Biology of Skeletal Muscle. Focus on the molecular and cellular biological approaches to skeletal muscle development and physiology. Topics include the role of cell lineage, developmentally preprogrammed patterns of contractile protein expression, the nature of muscle fiber diversity and the genetic mechanisms that generate contractile protein heterogeneity. 3 units. *Schachat*

237. Analytical Imaging in Biomedical Research. Weekly seminars to discuss concepts and techniques in high resolution analytical imaging of cells and subcellular organelles and to review application of these concepts to structural-functional correlations in cell physiology and pathophysiology. 3 units. *Ingram, Kopf, and LeFurgey*

243. Environmental Biochemistry. Introduction to the (macro)molecules of life and fundamental metabolic pathways. Topics are presented in the context of environmental perturbations. Fundamental aspects of energetics, proteins, enzymes, carbohydrates, lipids, and nucleic acids. Emphasis on mechanisms of adaptation, molecular controls, and responses to toxicants. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Environment 243 and Marine Sciences. 3 units. *Bonaventura and Brouwer*

244. Cellular and Molecular Research Techniques. Introduction to the use of electrophoresis, chromatography, enzymology, equilibrium assays, rapid reaction kinetics, microscopy, molecular graphics, and various modes of spectroscopy in analyzing molecules and tissues of organisms collected from polluted and pristine environments. The applicability of techniques of modern molecular biology are discussed in relation to other research techniques used to examine fundamental molecular mechanisms and the adverse effects of pollutants on natural processes. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Environment 244 and Marine Sciences. 3 units. *Bonaventura and Brouwer*

259. Molecular Biology I: Proteins and Enzymes. Prerequisite: introductory biochemistry or consent of instructor. See C-L: Cell and Molecular Biology 259; also C-L: Biochemistry 259, Immunology 259, and Microbiology 259. 3 units. *Richardson and staff*

268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and BCH/CMB/CBI/IMM/MIC 259, or consent of instructor. See C-L: Cell and Molecular Biology 268; also C-L: Biochemistry 268, Immunology 268, Microbiology 268, and The University Program in Genetics. 4 units. *Steege and staff*

269. Advanced Cell Biology. Prerequisite: introductory cell biology or consent of instructor. See C-L: Zoology 269; also C-L: Botany 269, Cell and Molecular Biology 269, Immunology 269, and Microbiology 269. 3 units. *Nicklas and staff*

270S. Molecular and Cellular Adaptations of Marine Organisms. Marine organisms meet the challenge of living in a hostile and ever-changing environment by numerous adaptive mechanisms. Focus on the underlying cellular and molecular processes. Topics explored with regard to adaptive processes in marine organisms include changes in metabolism, respiration, and vision. The impact of environmental pollutants and human health significance will also be addressed. (Given at Beaufort.) C-L: Marine Sciences. 2 units. *C. Bonaventura*

280. Student Seminar. Preparation and presentation of seminars to students and faculty on topics of broad interest to cell biology and physiology. Required of Department of Cell Biology students. 1 unit. *Staff*

301. Introduction to Cell and Molecular Biology. Three weeks of intensive laboratory exercises utilizing modern techniques of gene cloning; PCR; protein expression and purification; light and electron microscopy. Laboratory work will be supplemented with lectures and discussion groups. Course begins three weeks prior to the opening of the semester. 1 unit. *Titus and staff*

305. Selected Topics in Cardiac Physiology. Seminars will consider physiological and pathophysiological mechanisms that regulate cardiac cell function. Prerequisites: Cell Biology 200 or Cell Biology 203 and 204 or equivalent; and consent of instructor. 2 units. *Lieberman and staff*

311. Neurobiology of the Photoreceptor. Prerequisite: Neurobiology 208, 209, 211, 212 or equivalent recommended. See C-L: Neurobiology 311. 1 unit. *Corless and Wong*

312. Research. Specific areas of investigation include: membrane structure; extracellular matrix; cell adhesion; cell motility; cytoskeletal elements; chromosome structure and movement; genetics and molecular biology of contractile proteins; muscle ultrastructure; gamete biology; molecular and structural biology of photoreceptors; hormone receptors; cell growth; developmental biology; membrane transport and electrophysiology; metabolism; cardiovascular physiology; microcirculation; hyperbaric physiology; and theoretical studies and computer modeling of physiological processes. Variable credit. *Staff*

320. Research Problems in Cell Biology. Coverage of selected topics important in current cell biology research. Format includes faculty lectures and directed readings of current research papers presented and discussed by students. 3 units. *Sheetz and staff*

417. Cellular Signaling. Mechanism of action of hormones at the cellular level including hormone-receptor interactions, secondary messenger systems for hormones, mechanisms of regulation of hormone responsiveness, regulation of growth, differentiation and proliferation, mechanisms of transport and ion channels, stimulus sensing and transduction. Some lectures stress the clinical correlation of the basic course concepts. C-L: Biochemistry 417 and Pharmacology 417. 3 units. *Bell, Caron, Casey, Means, and invited lecturers*

COURSES CURRENTLY UNSCHEDULED

217. Selected Membrane Transport

Chemistry

Professor Crumbliss, *Chair* (101 Gross Chemical Laboratory); Professor McGown, *Director of Graduate Studies* (329 Gross Chemical Laboratory); Professors Baldwin, Bonk, Chesnut, Fraser-Reid, Lochmüller, McPhail, Palmer, Porter, Shaw, Smith, and Wells; Associate Professors Henkens and Pirrung; Assistant Professors Coury, MacPhail, Polniaszek, Prisant, Toone, and Yang; Professors Emeriti Arnett, Bradsher, Brown, Hobbs, Poirier, Quin, Strobel, and Wilder; Adjunct Professors Andrews, Chao, Ghirardelli, Spielvogel, and Sternbach

In the Department of Chemistry graduate work is offered leading to the M.S. and Ph.D. degrees. Before undertaking a graduate program in chemistry, a student should have taken an undergraduate major in chemistry, along with related work in mathematics and physics. Graduate courses in the department are offered in the fields of analytical, biological, inorganic, organic, and physical chemistry. Research programs are active in

all these fields. A booklet providing detailed information on the department is available from the director of graduate studies.

For Seniors and Graduates

201. Molecular Spectroscopy. Selected spectroscopic methods in the study of molecular structure. Symmetry and group theoretical basis for selection rules, theories of magnetic and optical resonance, and interpretation of spectra; examples from both inorganic and organic chemistry. Three lectures. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. 1 to 3 units. Variable credit. *Baldwin, Fraser-Reid, Palmer, Pirrung, Prisant, and Smith*

203. Quantum Chemistry. Basic principles of quantum and group theoretical methods. Topics include symmetry and a review of the fundamentals and the mathematical foundations of quantum theory. Emphasis on the application of molecular orbital theory to organic and inorganic systems. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. 1 to 3 units. Prerequisite: Chemistry 162L. Variable credit. *Chesnut, MacPhail, Polniaszek, and Porter*

205. Structure and Reaction Dynamics. Structure and mechanisms in organic and inorganic compounds, substitution reactions, linear free energy relations, and molecular rearrangements. Emphasis on the use of kinetic techniques to solve problems in reaction mechanisms. Three lectures. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. 1 to 3 units. Variable credit. *Crumbliss, Polniaszek, Porter, Toone, and Wells*

207. Principles of Kinetics, Thermodynamics, and Diffraction. Three lectures. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. 1 to 3 units. Variable credit. *McPhail, Prisant, Smith, and Yang*

275, 276. Advanced Studies. (1) Analytical chemistry, (2) inorganic chemistry, (3) organic chemistry, and (4) physical chemistry. Open to especially well-prepared undergraduates by consent of Director of Undergraduate Studies. 3 units each. *Staff*

For Graduates

300. Basic Statistical Mechanics. Fundamentals of quantum and classical statistical mechanics using the ensemble approach. Emphasis on systems of weakly interacting particles with internal degrees of freedom. 3 units. *Staff*

302. Basic Quantum Mechanics. The fundamentals of quantum mechanics with special emphasis on chemical applications. Topics included are: linear algebra, the uncertainty relations, angular momentum, perturbation theory and time dependent phenomena, molecules in electromagnetic fields, group methods, and electron correlation. 3 units. *Staff*

303, 304. Special Topics in Physical Chemistry. Presentation of one or more topics of staff interest such as advanced methods in crystallography, light scattering and small angle X-ray diffraction, application of ESR spectroscopy to chemical problems, electronic spectroscopy of proteins, group theory, intermolecular forces, liquid crystals, methods of determining the rates of elementary steps in reaction kinetics, physical chemistry of aerosols, physical-chemical methods of polymer characterization, structure and bonding in metallo-enzymes, statistical mechanics of fluids, topics in structural chemistry, and triplet excitons. 1 to 3 units each. Variable credit. *Staff*

306. Biophysical Chemistry. The interrelationships between structure, function, and mechanisms of biological macromolecules. Principles of dynamics (including kinetics, reactivity, and transport) and structure (including thermodynamics, NMR, fluo-

rescence, CD spectroscopy, and other applicable biophysical techniques). 2 to 3 units. Variable credit. *Henkens or Shaw*

310. Electronic Structure and Spectroscopy of Transition Metal Compounds. The theory of ligand fields and its application to the electronic spectroscopy, electron spin resonance, and magnetism of transition metal compounds. 2 units. *Palmer*

312. Chemistry of the Main Group Elements. Preparations, bonding, structures, and reactivity of compounds of the main group elements with emphasis on members of the *p* block groups. 3 units. *Crumbliss and Wells*

313. Special Topics in Inorganic Chemistry. Lectures, oral reports, and discussions on advanced topics and recent advances in the field of inorganic chemistry. Examples of topics which may be discussed are bioinorganic chemistry, fluxional molecules, homogeneous catalysis, synthesis and properties of selected groups of compounds, and new physical methods. 1 to 3 units. Variable credit. *Staff*

314. Advanced Inorganic Reaction Mechanism. A discussion of the mechanism of coordination and organometallic reactions in solvent solution. Examples include redox reactions and linear free energy relationships. Consent of instructor required. 2 units. *Crumbliss*

320. Synthetic Organic Chemistry. A study of the scope and limitations of the more important types of reactions in synthetic organic chemistry. Some discussion of the rapidly developing use of transition metals, complex hydrides, and photochemistry will be included. 3 units. *Baldwin, Fraser-Reid, or Polniaszek*

322. Organic Reactive Intermediates. A discussion of reactive intermediates in organic chemistry. Topics will include carbanions, carbenes, carbonium ions, free radicals, photochemical excited states, and other reactive species. 3 units. *Porter*

324. Special Topics in Organic Chemistry. Advanced topics and recent developments in the field of organic chemistry. Representative topics include heterocyclic chemistry, natural products chemistry, carbohydrate chemistry, molecular mechanics, and two-dimensional NMR spectroscopy. Lectures and written and oral reports. 1 to 3 units. Variable credit. *Staff*

326. Bioorganic Chemistry. An investigation of biochemical principles from the viewpoint of the organic chemist. Fundamental and applied enzymology, enzyme inhibition, enzyme models, biosynthetic pathways, methodology for the study of biological transformations, molecular biology for organic chemists. 3 units. *Pirrung and Toone*

330. Separation Science. Section .01, fundamental separation chemistry; section .02, practical aspects of chromatographic methods; section .03, larger scale processes. 1 to 3 units. C-L: Biochemical Engineering 330. Variable credit. *Lochmüller*

331, 332. Special Topics in Analytical Chemistry. An advanced treatment of important areas in modern analysis. Possible topics include: electrochemistry, small computer applications, magnetic resonance, and problem-solving approaches. 1 to 3 units each. Variable credit. *Staff*

334. Electroanalytical Chemistry. Fundamentals and applications of techniques for probing heterogeneous charge transfer reactions, including cyclic voltammetry at conventional and ultra micro electrodes. 2 units. *Coury*

336. Analytical Spectroscopy. Fundamentals of atomic and molecular spectroscopies for chemical analysis, emphasizing absorption, emission, and luminescence techniques. 2 units. *McGown*

373, 374. Seminar. One unit is required of all Ph.D. candidates in chemistry. One hour a week discussion. 1 unit each. *All members of the graduate staff*

375, 376. Research. Instruction in methods used in the investigation of original problems. Individual work and conferences. 1 to 6 units each. Variable credit. *All members of the graduate staff*

377. Research Orientation Seminar. A survey of departmental research. Required of all entering graduate students in chemistry. Consent of Director of Graduate Studies required. 1 unit. *All members of the graduate staff*

Classical Studies

Associate Professor Rigsby, *Chair* (233A Allen); Professor Oates, *Director of Graduate Studies* (229A Allen); Professors Clay, Connor, Newton, and Younger; Associate Professors Boatwright, Burian, and Stanley; Assistant Professor Janan; Professors Emeriti Richardson and Willis; Senior Lecturing Fellow Zarker

The Department of Classical Studies offers graduate work leading to the A.M. and Ph.D. degrees in classical studies. Work in the department encompasses all aspects of the Greco-Roman world: students in the program are able, through course work, directed research, and their own teaching, to prepare for careers of teaching and research as broadly trained classical scholars. For regular admission, students should offer at least three years of college study in one of the classical languages and two in the other. Before developing a specialization within the program, students are expected to acquire facility in both Greek and Latin, a broad knowledge of the literatures and of ancient history and archaeology, and command of research methods. Reading knowledge of French and German is required for the Ph.D. The resources of the department include important collections of Greek and Latin manuscripts and papyri, computer facilities in the ancient languages, and a valuable study collection of Greek and Roman art. The journal *Greek, Roman, and Byzantine Studies* is published at Duke. The director of graduate studies will provide on request a brochure giving further information about the department's requirements, resources, and financial aid; prospective students should also consult the general requirements of the university set forth in the chapter on "Registration" in this bulletin.

GREEK

For Seniors and Graduates

200. Readings in Greek Literature. 3 units. *Staff*

201. Studies in Greek Literature I. 3 units. *Staff*

202. Studies in Greek Literature II. 3 units. *Staff*

205. Greek Lyric Poets. Fragments of the early lyric poets; selected odes of Pindar and Bacchylides. 3 units. *Burian or Stanley*

207. The Dramatists. Readings and studies of selected plays by the major playwrights Aeschylus, Sophocles, Euripides, and Aristophanes. 3 units. *Burian*

209. Introduction to Hellenistic Literature. Readings in selected texts of the period from Alexander to Augustus, including historical narratives, documents, philosophical and scholarly treatises, drama, and poetry. 3 units. *Rigsby*

210. Alexandrian Poetry. Emphasis on the *Argonautica* of Apollonius of Rhodes, and attention to the shorter poems of Theocritus and Callimachus. 3 units. *Stanley*

226. The Orators. Selections from the principal Attic orators, with emphasis on Lysias and Demosthenes. 3 units. *Connor*

For Graduates

301. Seminar in Greek Literature I. Selected authors and topics. 3 units. *Burian, Clay, or Stanley*

302. Seminar in Greek Literature II. Selected authors and topics. 3 units. *Burian, Clay, or Stanley*

313. Seminar in Greek Epigraphy. 3 units. *Rigsby*

399. Directed Reading and Research. Credit to be arranged. Variable credit. *Staff*

Courses Currently Unscheduled

203. Homer

221. Early Greek Prose

222. The Historians

321. Seminar in Literary Papyri

LATIN

For Seniors and Graduates

200. Readings in Latin Literature. 3 units. *Staff*

201. Studies in Latin Literature I. 3 units. *Staff*

202. Studies in Latin Literature II. 3 units. *Staff*

205. The Roman Novel. Readings in Petronius and Apuleius. 3 units. *Richardson*

206S. Cicero. 3 units. *Richardson*

208S. Lyric and Occasional Poetry. Readings in the works of Catullus, Horace, and Martial. Same as 108S, except additional term paper required. 3 units. *Janan or Newton*

211S. Elegiac Poets. Analysis of most of the *corpora* of Propertius, Tibullus, and Ovid with close attention to the stylistics of the poems, their place in the traditions of Latin love elegy, and their relation to other phenomena of the Augustan period. Not open to students who have taken Latin 111S. 3 units. *Richardson*

214S. The Historians. Investigations of the Romans' conceptions and practices of writing history, based on detailed analysis of the works of Sallust, Livy, and Tacitus. Additional readings in the fragments of other Latin historians, and in comparative Greek historians. Not open to students who have taken Latin 114S. 3 units. *Boatwright or Richardson*

217T. Latin Prose Composition. The course content is determined by the needs of the students enrolled. 3 units. *Staff*

221. Medieval Latin. Selected works of the Latin Middle Ages from Prudentius to the humanists. Genres studied usually include the hymn, sequence, drama, lyric, saints' lives, chronicle, epic, and epistle. C-L: Medieval and Renaissance Studies. 3 units. *Newton*

For Graduates

301. Seminar in Latin Literature I. Selected authors and topics. 3 units. *Boatwright, Janan, or Newton*

302. Seminar in Latin Literature II. Selected authors and topics. 3 units. *Boatwright, Janan, or Newton*

312. Seminar in Latin Palaeography. 3 units. *Newton*

315. Seminar in Roman Law. 3 units. *Oates*

399. Directed Reading and Research. Credit to be arranged. Variable credit. *Staff*

Courses Currently Unscheduled

204. Epic of the Silver Age

207S. Vergil's *Aeneid*

314. Seminar in Latin Epigraphy

CLASSICAL STUDIES

For Seniors and Graduates

211S. Plato. Selected dialogues. C-L: Philosophy 211S. 3 units. *Ferejohn*

217S. Aristotle. Selected topics. C-L: Philosophy 217S. 3 units. *Ferejohn*

220S. Topics in Greek Art. Consent of instructor required. See C-L: Art 201S. 3 units. *Staff*

221. Archaic Greece. Greece and the Near East from the end of the Bronze Age to the Persian Wars. C-L: History 259. 3 units. *Oates or Rigsby*

222. Fifth and Fourth Century Greece. From the Persian Wars to the dominance of Philip of Macedon. C-L: History 260. 3 units. *Oates or Rigsby*

223. Alexander and the Hellenistic World. The achievements and legacy of Alexander the Great and the rise of Roman power in the Eastern Mediterranean. C-L: History 261. 3 units. *Oates*

224. The Roman Republic. The rise of Rome, to its mastery of the Mediterranean; the political, social, and intellectual consequences. C-L: History 263. 3 units. *Boatwright or Rigsby*

225. The Roman Empire. The foundation, consolidation, and transformation of Roman rule from Augustus to Diocletian. C-L: History 264. 3 units. *Boatwright*

227S. Topics in Roman Art. Consent of instructor required. See C-L: Art 202S. 3 units. *Staff*

230S. Topics in Early Christian and Byzantine Art. Consent of instructor required. See C-L: Art 233S; also C-L: Medieval and Renaissance Studies and Religion 275S. 3 units. *Wharton*

231S. Greek Sculpture. Free standing, relief, and architectural sculpture from the archaic period to the Hellenistic age, representing changing aesthetic, social, and political aims. C-L: Art 238S. 3 units. *Younger*

232S. Greek Painting. From the Late Bronze Age to the fourth century B.C., with emphasis on archaic and classical Athenian vase painters. C-L: Art 237S. 3 units. *Stanley*

233S. Greek Architecture. Development of form and function in the various religious, civic, and domestic building types, from the Bronze Age through the Hellenistic period. C-L: Art 205S. 3 units. *Richardson or Younger*

236S. Roman Painting. The techniques, iconography, and use in decoration. C-L: Art 227S. 3 units. *Richardson*

258. The Hellenistic and Roman East. The social and cultural history of the Greco-Roman world, concentrating on papyrological evidence. Prerequisites: knowledge of ancient Greek and Latin. 3 units. *Oates*

For Graduates

301. Proseminar: Introduction to Classical Studies. 3 units. *Rigsby*

311. Archaeology Seminar I. Selected topics. 3 units. *Staff*

312. Archaeology Seminar II. Selected topics. 3 units. *Staff*

321. Seminar in Ancient History I. Selected topics. 3 units. *Boatwright, Oates, or Rigsby*

322. Seminar in Ancient History II. Selected topics. 3 units. *Boatwright, Oates, or Rigsby*

399. Directed Reading and Research. Credit to be arranged. Variable credit. *Staff*

Courses Currently Unscheduled

226. Late Antiquity

234S. Roman Sculpture

235S. Roman Architecture

327. Seminar in Byzantine History

Under the terms of a cooperative agreement, graduate students of Duke University may take any graduate course offered by the Department of Classics of the University of North Carolina. A list of these courses will be sent upon request.

Computer Science

Professor Vitter, *Chair* (206 North Building); Associate Professor Greenside, *Director of Graduate Studies* (240 North Building); Professors Behringer, Biermann, Loveland, Marinos, Patrick, Reif, Rose, Starmer, Trivedi, and Utku; Associate Professors Agarwal, Dugan, Ellis, Gardner, Kedem, and Wagner; Assistant Professors Chowdhury, Dolas, Holliday, Kao, Lanzkron, Prisant, and Nadathur; Professor Emeritus Gallie; Research Associate Professor Ramm; Adjunct Associate Professor Coughran; Adjunct Assistant Professor McHugh

The Department of Computer Science offers programs leading to the M.S. and Ph.D. degrees. The department also actively cooperates with the Department of Computer Science of the University of North Carolina at Chapel Hill.

A student entering graduate work in computer science should have had three semesters of calculus and one semester of linear algebra, and should have a knowledge of data structures, and of assembler as well as higher-level computer programming languages. Research interests of present faculty include mathematical foundations of computer science, artificial intelligence, analysis of algorithms, programming methodology, real-time computing, operating data base systems, computer systems design and

analysis, parallel processing systems, scientific computation (including numerical analysis), and VLSI design.

Each student should consult the document *Graduate Degree Requirements of the Computer Science Department* for degree requirements not listed in this bulletin.

For Seniors and Graduates

200. Programming Methodology. Practical and theoretical topics including structured programming, specification and documentation of programs, debugging and testing strategies, choice and effective use of programming languages and systems, psychology of computer programming, proof of correctness of programs, analysis of algorithms, and properties of program schemata. Prerequisite: Computer Science 103. 3 units. *Staff*

201. Programming Languages. Information binding, data structures and storage, control structures, recursion, execution environments, input/output; syntax and semantics of languages; study of PL/1, Fortran, Algol, APL, LISP, SNOBOL, and SIMULA; exercises in programming. Prerequisite: Computer Science 200. 3 units. *Staff*

202. Applied Discrete Structures. Aspects of discrete mathematics that are essential to the development of computer science. Topics from combinatorics and graph theory, discrete probability theory, and mathematical logic. Prerequisites: Mathematics 103 and 104 or equivalents. 3 units. *Staff*

205. Analysis of Algorithms. Design and analysis of efficient algorithms. Algorithmic paradigms. Applications include sorting, searching, dynamic structures, graph algorithms, randomized algorithms. Computationally hard problems. NP completeness. Prerequisite: Computer Science 103 or equivalent. 3 units. *Agarwal, Kao, Reif, or Vitter*

206. Numerical and Algebraic Algorithms. Introduction to polynomial problems, matrix problems—general and sparse; numerical algorithms, fast Fourier transform, eigenvalue computation, number theory and cryptography. Prerequisites: Computer Science 205 and 222, or equivalents. 3 units. *Reif or Rose*

207. Fault-Tolerant Computer Systems. Prerequisite: Electrical Engineering 151 or equivalent. See C-L: Electrical Engineering 254. 3 units. *Marinos*

210. Introduction to VLSI Systems. A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Prerequisite: Electrical Engineering 151 or equivalent; Electrical Engineering 161 or equivalent. 3 units. *Dollas or Kedem*

212. Introduction to Scientific Computing. Practical introduction for students and faculty to computer resources that facilitate scientific research: scientific word processing (Tex and LaTeX), symbolic manipulation programs, software tools, numerical software packages, and graphics. Case studies used to illustrate these resources. For noncomputer scientists. Prerequisite: Mathematics 103, 104, or equivalent; some programming experience. 3 units. *Gardner or Greenside*

213. Nonlinear Dynamics. Introduction to the mathematical theory of nonlinear dynamics, and how this theory compares with physical experiments, with applications to biology (Turing states and morphogenesis), computer science (randomness and computability), mathematics (chaos and strange attractors), and physics (pattern formation and transition to turbulence). Prerequisites: Computer Science 53, Mathematics 111, and Physics 51L, 52L. C-L: Physics 213. 3 units. *Behringer or Greenside*

215. Artificial Intelligence. Heuristic versus algorithmic methods; programming of games such as chess; theorem proving and its relation to correctness of programs; readings in simulation of cognitive processes, problem solving, semantic memory, analogy, adaptive learning. Prerequisite: Computer Science 103 or consent of instructor. 3 units. *Biermann, Loveland, or Nadathur*

218. Logic for Computer Science. Aspects of logic with a focus on computational issues. Topics include propositional and predicate calculi and the theory underlying their automation, that is, the compactness theorems, the Herbrand-Skolem-Gödel theorem, unification, and resolution. Proof procedures and their search characteristics. The use of natural deduction and sequent calculi in describing logics, specifying programming language semantics and formalizing type systems. Structural properties, such as cut-elimination, in such systems. The logical systems underlying programming languages like Prolog and ML. Applications of logic in automated reasoning, program verification and synthesis. C-L: Philosophy 210. 3 units. *Loveland or Nadathur*

221. Numerical Analysis. Error analysis, interpolation and spline approximation, numerical differentiation and integration, solutions of linear systems, nonlinear equations, and ordinary differential equations. Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. C-L: Mathematics 221 and Statistics 273. 3 units. *Gardner, Greenside, Lanzkron, or Rose*

222. Numerical Differential Equations. Numerical methods for solving ordinary and partial differential equations emphasizing nonlinear differential equations. Methods for solving ordinary differential equations that generalize to solve partial differential equations: finite difference, spectral, and finite element methods. Solution of hyperbolic, parabolic, and elliptical partial differential equations arising in scientific problems. Prerequisite: Computer Science 221. C-L: Mathematics 222. 3 units. *Gardner, Greenside, Lanzkron, or Rose*

223. Numerical Linear Algebra. Solution of large, sparse linear systems of equations. Storage schemes, graph theory for sparse matrices, different orderings to minimize fill, block factorizations, iterative methods, analysis of different splittings, conjugate gradient methods. Eigenvalue problems, QR factorization, Lanczos method, power method and inverse iteration, Rayleigh quotient. Prerequisite: Computer Science 221 or equivalent. C-L: Mathematics 223. 3 units. *Lanzkron or Rose*

225. Formal Languages and Theory of Computation. An introduction to the study of abstract machines and the languages they define, their capabilities, and limitations. Finite-state automata, regular languages, pushdown automata, context-free languages, Turing machines, recursive functions and recursively enumerable sets, noncomputable sets, measures of complexity for algorithms. Prerequisite: four courses in college mathematics. 3 units. *Loveland or Reif*

226. Mathematical Methods for Systems Analysis I. Basic concepts and techniques used in the stochastic modeling of systems. Elements of probability, statistics, queuing theory, and simulation. Prerequisite: four semesters of college mathematics. C-L: Electrical Engineering 255. 3 units. *Trivedi*

230. Parallel Algorithms. Models of parallel computation including parallel random access machines, circuits, and networks; NC algorithms and P-completeness; graph algorithms, sorting algorithms, network routing, tree contraction, string matching, parsing algorithms; randomization and derandomization techniques. Prerequisite: Computer Science 205 or equivalent. 3 units. *Kao or Reif*

231. Operating Systems. Fundamental principles of operating system design applied to state-of-the-art computing environments (multiprocessors and distributed

systems) including process management (coscheduling and load balancing), shared memory management (data migration and consistency), and distributed file systems. Advanced topics include transaction-based operating systems, reliable communication protocols, concurrency control and recovery mechanisms, computer security, and performance analysis. 3 units. *Ellis*

232. Compiler Construction. Models and techniques used in the design and implementation of assemblers, interpreters, and compilers. Lexical analysis, compilation of arithmetic expressions and simple statements, specifications of syntax, algorithms for syntactic analysis, code generation and optimization techniques. 3 units. *Chowdhury*

240. Computational Geometry. Models of computation and lower-bound techniques; storing and manipulating orthogonal objects; orthogonal and simplex range searching, convex hulls, planar point location, proximity problems, arrangements, linear programming and parametric search technique, probabilistic and incremental algorithms. Prerequisite: Computer Science 205 or equivalent. 3 units. *Agarwal or Reif*

241. Data Base Methodology. Basic concepts and principles. Relational, hierarchical, and network approaches to data organization; data entry and query language support for data base systems; theories of data organization; security and privacy issues. Prerequisites: Computer Science 104 and either 155 or equivalent. 3 units. *Holliday*

245. Functional Analysis for Scientific Computing. Linear spaces, topologies, norms, and completeness. Focus on Banach and Hilbert spaces including Sobolev spaces. Linear and nonlinear operators. Fréchet derivatives. Iterative methods for nonlinear operator systems, such as Newton-like methods. Applications. Intended for science and engineering students but not mathematics graduate students. Prerequisite: Computer Science 221. C-L: Mathematics 245. 3 units. *Rose*

252. Computer Systems Organization. Hardware and software aspects. Processor, memory, device, and communication subsystems; case studies of hardware system organization, for example, parallel, associative, fault-tolerant; organization of software systems to exploit hardware systems organization; economic and reliability aspects of various hardware organizations. Prerequisites: Computer Science 104 and 157. 3 units. *Wagner*

255. Computer Networks and Distributed Systems. Basic systems support for process-to-process communications across a computer network. The TCP/IP protocol suite and the Berkeley sockets application programs interface. Development of network application programs based on the client-server model. Remote procedure call and implementation of remote procedure call. Prerequisite: knowledge of the C programming language. 3 units. *Chowdhury*

265. Advanced Topics in Computer Science. 3 units. *Staff*

For Graduates

308. Advanced Topics in Digital Systems. Prerequisite: Electrical Engineering 252 or equivalent. See C-L: Electrical Engineering 352. 3 units. *Staff*

310. Advanced VLSI Design. Theory of advanced VLSI design. Specifications development, methodology, issues, circuit-level trade-offs. Full custom design, standard cell design, gate array design, silicon compilation. Semiconductor technologies and logic families for semi-custom design. Clocking schemes and distribution, race conditions. Design of a variety of circuits (adders, I/O drivers, RAM, FIFO, etc.) Testing of all phases in the life cycle of an integrated circuit. Top-down design and bottom-up implementation. Student projects. Prerequisite: Electrical Engineering 261 or equivalent. C-L: Electrical Engineering 361. 3 units. *Dollas and Kedem*

315. Advanced Topics in Artificial Intelligence. Course content will vary from year to year and will include a detailed study of one or more of the following: mechanical theorem proving, natural language processing, automatic program synthesis, machine learning and inference, representations of knowledge, languages for artificial intelligence research, artificial sensorimotor systems, and others. Prerequisite: Computer Science 215. 3 units. *Biermann, Loveland, or Nadathur*

320. VLSI Algorithmics. Algorithmic and systems aspects of VLSI. Topics include theoretical studies of the layout problem, array logic, placement and routing, fault-tolerance in VLSI designs, design for testability, the design of networks of processors, and cost trade-offs in VLSI designs. Each student will complete an in-depth study of a topic approved by the instructor. Prerequisites: Computer Science 224 and either 210 or 310. 3 units. *Staff*

321. Topics in Numerical Mathematics. Advanced topics in numerical mathematics to be selected from areas of current research. Prerequisites: Computer Science 221 and 222. 3 units. *Gardner, Greenside, Lanzkron, or Rose*

331. Operating Systems Theory. Advanced study of theoretical aspects of operating systems emphasizing models and control of concurrent processes, processor scheduling, and memory management. Prerequisites: Computer Science 226 and 231. 3 units. *Ellis or Wagner*

381. Seminar in Computer Systems Analysis. Topics in computer systems analysis, especially for fault-tolerant systems, including reliability, availability and performance analysis, comparative analysis of architectures, performability, analytic and numerical solution techniques, stochastic Petri nets, simulation. 1 to 3 units. Variable credit. *Dugan or Trivedi*

382. Seminar in Artificial Intelligence. Topics in artificial intelligence, such as natural language understanding, learning, theorem proving and problem solving, search methodologies. Topics will vary from semester to semester. Includes research literature reading with student presentation. 1 to 3 units. Variable credit. *Staff*

395. Research. Instruction in methods used in the investigation of original problems. Individual work and conferences. 1 to 6 units. Variable credit. *All members of the graduate staff*

COURSES CURRENTLY UNSCHEDULED

227. Mathematical Methods for Systems Analysis II

276. Communication, Computation, and Memory in Biological Systems

301. Topics in Programming Theory

325. Theory of Computation

326. Systems Modeling

332. Topics in Operating Systems

SUPPLEMENTARY COURSES OFFERED AT UNC-CH

Comp 145. Software Engineering Laboratory

Comp 171. Natural Language Processing

Comp 230. File Management Systems

Comp 236. Computer Graphics

Comp 238. Raster Graphics

Comp 254. Picture Processing and Pattern Recognition

Comp 265. Architecture of Computers

Cultural Anthropology

Associate Professor Quinn, *Chair*; Assistant Professor Ewing, *Director of Graduate Studies* (102 Social Sciences); Professors Apte, Mudimbe (literature), O'Barr, and Reddy (history); Associate Professor Silverblatt; Assistant Professors Allison, Starn, and Strauss; Professors Emeriti Friedl and La Barre; Adjunct Professor Conley; Lecturer Luttrell

The department offers graduate work leading to the Ph.D. degree in cultural anthropology. It also participates in a program with the law school leading to a joint J.D./M.A. degree. Students' active role in development of their own research goals and design of their own plan of study, as well as their pursuit of relevant cross-disciplinary background, within and outside the department, is expected. Courses in anthropological theory and research methodology, as well as spoken and/or written competence in at least one foreign language, at the level appropriate to the planned research program, are required. The core courses include two year-long sequences: Theories in Cultural Anthropology (330S, 331S), required of first-year graduate students, and Research Seminar in Cultural Anthropology (332S, 333S), required of second-year students. Students must also take an approved methods course. Summer field research is strongly encouraged. The *Guidelines for Graduate Students in the Doctoral Program in Cultural Anthropology* and the *Guidelines for Graduate Students in the J.D./M.A. Program* fully describe these and additional requirements and the detailed steps in the student's graduate career.

For Seniors and Graduates

207S. Anthropology and History. Recent scholarship that combines anthropology and history, including culture history, ethnohistory, the study of mentalité, structural history, and cultural biography. The value of the concept of culture to history and the concepts of duration and event for anthropology. Prerequisite: major in history, one of the social sciences, or comparative area studies; or graduate standing. C-L: History 210S. 3 units. *Reddy*

208S. Postcolonial Anthropology. Review and critique of postcolonial ethnographies and other writings through study of recent work in the history of scientific discovery and the sociology of knowledge. 3 units. *Starn*

211S. Ethnography of Communication. History of the mutual influence of linguistics and anthropology leading to the development of ethnography of speaking, ethno-science, structuralism, and sociolinguistics. Topics vary each semester. Prerequisite: Cultural Anthropology 107 or 119. 3 units. *Apte or O'Barr*

214. Postmodernism and the Problem of Representation. How postmodernism has shaped recent anthropological discourse. Analysis of the premises of postmodernist epistemology and identification of key issues such as truth, authority, and power that are raised by postmodernist critiques of ethnographic representation. Examination of both traditional and experimental ethnographies. 3 units. *Ewing*

215S. The Anthropology of Women: Theoretical Issues. Topic to be selected each semester from: gender ideology, women and work, gender inequality, the history of feminist anthropology, or others. C-L: Women's Studies. 3 units. *Luttrell, Quinn, or Starn*

216S. Gender, Race, and Class. Gender, race, and class as theoretical constructs and lived experiences. Analytical frameworks include social history, discourse analysis, critical theory, cultural studies, and feminist theories. Consent of instructor required. 3 units. *Luttrell*

217. Culture Versus Nature? History and Ecology in Anthropology. Historical and evolutionary approaches to the ways that human cultures and natural environments have modified and constrained one another; focus on technologies rather than on national or international environmental policy. Consent of instructor required. 3 units. *Staff*

234S. Political Economy of Development: Theories of Change in the Third World. See C-L: Political Science 234S; also C-L: History 234S and Sociology 234S. 3 units. *Staff*

250S. Culture and Discourse. Theoretical approach to culture and methods for the investigation of culture through analysis of discourse, especially interview texts. Application of this approach and these methods to the study of a domain of American culture. 3 units. *Apte, Ewing, O'Barr, Quinn, or Strauss*

251. Cognitive Anthropology. A cognitively-based theory of culture, its history, justification, substantiation through discourse analysis, application to everyday understanding, feeling and motivation, and implications for the acquisition of culture, cross-cultural variation and cultural universals in human thought. Not open to students who have taken Cultural Anthropology 151. 3 units. *Quinn or Strauss*

253S. Cross-Cultural Studies of Humor. Sociocultural basis, nature, scope, and function of humor. 3 units. *Apte*

257S. Food in Cross-Cultural Perspectives. The behavioral, institutional, linguistic, religious, and ideological aspects in relation to the production, distribution, and consumption of food within and across cultures. 3 units. *Apte*

258S. Theories of Symbolism. Influential interpretations of symbols, what they do, and how they do it. The relationship of language to symbolism and symbolism to power. Prerequisites: junior/senior status and at least two courses in cultural anthropology, or graduate standing. 3 units. *Ewing*

261. Religion: Tradition and Cultural Innovation. Analysis of anthropological approaches to religion, with an emphasis on how these theories account for conflict and change as they are manifested in religious symbols and ritual action. 3 units. *Ewing*

262S. Anthropology and Folklore. Origins, conceptualizations and theoretical orientations, methodology, and subject matter of the discipline of folklore and exploration of its similarities with and differences from sociocultural anthropology. 3 units. *Apte*

280S, 281S. Seminar in Selected Topics. Special topics in methodology, theory, or area. Consent of instructor required. 3 units each. *Staff*

282S. Canada. See C-L: History 282S; also C-L: Economics 282S, Political Science 282S, and Sociology 282S. 3 units. *Cahow or Thompson*

For Graduates

330S, 331S. Theories in Cultural Anthropology. A two-semester seminar in which the historical development of the field and its modern currents and debates are examined and discussed. Particular topics to be chosen by the instructors. 3 units each. *Staff*

332S, 333S. Research Seminar in Cultural Anthropology. Yearlong projects, from research design and formal proposal through location of research site, data collection, data analysis and theory development to write-up. Approaches, methods, and lessons appropriate to these projects. 3 units each. *Staff*

393. Individual Research in Cultural Anthropology. Supervision and guidance of A.M. thesis preparation, Ph.D. dissertation preparation, or other intensive research on a selected problem. 3 units. *Staff*

COURSES CURRENTLY UNSCHEDULED

201S. Marxism and Anthropology

219. Language and Social Theory

239. Culture and Ideology

252S. American Marriage: A Cultural Approach

272S. Marxism and Feminism

284S. Feminist Theory and the Social Sciences

Economics

Professor de Marchi, *Chair* (215A Social Sciences); Professor Kimbrough, *Director of Graduate Studies* (209 Social Sciences); Professors Bates, Clotfelter, Cook, Gillis, Goodwin, Grabowski, Graham, Havrilesky, Kelley, Krueger, Ladd, McElroy, Moulin, Sloan, Tauchen, Tower, Trembl, Vernon, Viscusi, Wallace, Weintraub, and Yohe; Associate Professors Conrad, Kramer, Leitzel, and Marshall; Assistant Professors Bansal, Baumgardner, Gentry, Hamilton, Meurer, Parks, Swenson, and Yang; Professors Emeriti Blackburn, Bronfenbrenner, Davies, and Kreps; Research Professors Burmeister and Coats; Adjunct Professor Gallant; Adjunct Associate Professor Zarkin; Visiting Assistant Professors Choi, Coleman, and Ramachandran

The Department of Economics offers graduate work leading to the A.M. and Ph.D. degrees. Among the undergraduate courses of distinct advantage to the graduate student in economics are statistics, economic theory, and basic courses in mathematics and social sciences other than economics. Advanced work in mathematics or statistics is very useful.

Requirements for the Ph.D. degree in economics include courses in economic theory and econometrics in the first year. By the beginning of the third year, the student must have passed a core examination in economic analysis. In addition, a student must obtain certification in three fields, one of which may be in an outside minor. The student may select from advanced economic theory, health economics, history of political economy, economic development, economic history, international economics, money and banking, labor economics, public finance, industrial organization, econometrics, Soviet economics, and certain fields outside the economics department (e.g., finance, resource and environmental economics, statistics, or demography). Course work for the Ph.D. degree should be completed in five or six semesters of residence.

For Seniors and Graduates

205S. Advanced Monetary Theory and Policy. The theory of monetary policy from Keynesian, neoclassical and classical perspectives. Public choice and political economy approaches to monetary policy. The term structure interest rates. Portfolio theory. The theory of the financial services firm. Theories of financial regulatory policy. Prerequisites: Economics 153 and Statistics 10D. 3 units. *Havrilesky*

206S. Regulation and Industrial Economics. Analysis of industrial competition and performance in industries such as automobiles, telephones, cable TV, airlines, pharmaceuticals, tobacco, and health care services. Analysis of the efficiency of regulation and other public policy programs. Prerequisites: Economics 149 and statistics. 3 units. *Grabowski*

207. Models of Conflict and Cooperation. Cooperative and noncooperative game theory with applications to trading, imperfect competition, cost allocation, and voting. Prerequisites: Economics 149 and Mathematics 31. 3 units. *Moulin*

207S. Models of Conflict and Cooperation. Seminar version of 207. Prerequisites: Economics 149 and Mathematics 31. 3 units. *Moulin*

212S. Economic Science and Economic Policy. A historical examination of the impact of economics on public policy; topics vary each semester and have included energy and anti-inflation policy, productivity growth, the Third World, and the Council of Economic Advisers. Consent of instructor required. 3 units. *Goodwin*

215S. Applied Cost Benefit Analysis. The principles of economic cost benefit analysis applicable to circumstances in which market valuations do not provide adequate measures of social desirability. Socially relevant prices for labor, capital, energy, materials, foreign exchange, and valuation of public goods. Development of analysis for individual projects, extended to cover economic policies. Prerequisite: Economics 149. 3 units. *Staff*

216S. Economics of Education. Topics include investment in human capital, return to and demand for education, the production function for schooling, public expenditures on schools, effectiveness of private and public schools, the distribution of public educational expenditures, public financing of higher education, inflation in college costs, and labor markets for teachers and professors. Emphasis on students' research projects. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Public Policy Studies 216S. 3 units. *Clotfelter*

218. Macroeconomic Policy. Does not count for undergraduate economics major requirements. See C-L: Public Policy Studies 218. 3 units. *Leitzel*

219S. Economic Problems of Underdeveloped Areas. Analysis of underdeveloped countries with attention to national and international programs designed to accelerate development. Prerequisite: Economics 149 or consent of instructor. 3 units. *Kelley or Krueger*

220S. Computer Modeling for Policy Analysis. Introduction to the use of computer techniques in economic policy evaluation; policy applications to international economics, public finance and development economics; computer analysis of linearized and nonlinear models. Students required to complete a major modeling project. Prerequisites: Economics 149 and Economics 154. 3 units. *Tower*

225S. Games and Information. Non-cooperative game theory with emphasis upon incomplete/imperfect information and incentive contracting. Applications to insurance (deductibles, coinsurance), labor (piece rates, sharecropping, profit sharing), real estate (commission sales), and law (contingent contracts). Prerequisites: Economics 149 and statistics. 3 units. *Graham*

232. Microeconomics: Policy Applications. Does not count for undergraduate economics major requirements. See C-L: Public Policy Studies 232. 3 units. *Conrad or Ladd*

234. Japanese Economy and Its History. Japanese economic development since the end of isolation, in the mid-nineteenth century. Not open to students who have had

Economics 134. Prerequisite: one course in economics or Far Eastern history. 3 units. *Bronfenbrenner*

239. Introduction to Econometrics. Data collection, estimation, and hypothesis testing. Use of econometric models for analysis and policy. (Same as Economics 139 but requires additional term paper; not open to students who have taken Economics 139.) Prerequisites: Economics 2D or 2S or 52D and Mathematics 32 or equivalent and Statistics 10D or equivalent. 3 units. *McElroy, Pessino, Tauchen, or Wallace*

240. Comparative Economic Systems. Analysis and comparison of basic economic systems; market versus centrally planned economies; decision making, information, property rights (income and control), and incentives. Western industrialized market economies compared with Soviet-type command economies. Analysis of change, reforms, and of economic problems of systems transformation. Not open to students who have taken Economics 140. Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. 3 units. *Trembl*

241. Quantitative Methods. Various topics in linear algebra, advanced calculus, real analysis, statistics, econometrics, and computer programming, as relevant for Ph.D. level work in economics. Restricted to Ph.D. students in Economics except with consent of instructor and Director of Graduate Studies. Prerequisites: Economics 149 and 154; Mathematics 103, 104, or equivalent. 3 units. *Tauchen*

242. Chinese Economy. Tools of economic analysis applied to the Chinese economy since 1949. Exposition of commune system, agricultural procurement, state enterprise, and industrial price policies in the pre-reform era. Analysis of rural and urban reforms, and their effects on economic efficiency. (Same as Economics 142 but requires additional paper; not open to students who have taken Economics 142.) Prerequisites: Economics 1D or 51D, and 2D or 2S or 52D. 3 units. *Yang*

243. Econometrics I. Economic theory and statistics applied to analysis of economic phenomena. Matrix algebra and calculus used to develop methods for multiple regression and statistical inference. Prerequisite: Economics 241, 249, or equivalents. 3 units. *McElroy, Tauchen, or Wallace*

244. Education, Development, and Growth. The basic elements of human capital theory and its application to economic growth and development. Topics include human capital investment, life-cycle earnings, impact of education on farm efficiency, migration, national income accounting, and models of endogenous growth. Data from the United States and other countries are used to test theoretical implications. (Same as Economics 144 but requires additional work; not open to students who have taken Economics 144.) Prerequisites: Economics 149, Economics 154, and Statistics 110B. 3 units. *Yang*

245. Econometrics II. Asymptotic theory for finite dimensional parametric models. Topics include nonlinear maximum likelihood, nonlinear regression, extremum estimators, aspects of computation, hypothesis testing, and models with limited dependent variables. Prerequisite: Economics 243 or equivalent. C-L: Statistics 265. 3 units. *Tauchen*

246. Econometrics III. Advanced topics in econometrics including asymptotic theory, nonparametrics, and specification testing. Prerequisite: Economics 245. C-L: Statistics 266. 3 units. *Gallant and Tauchen*

247. Applied Econometrics. Application of current developments in econometric methodology to empirical problems in economics. Emphasis on the conduct of empirical research, including model and hypothesis formulation, testing, and integration of

economic and econometric theory. Prerequisite: Economics 243 or equivalent. 3 units. *McElroy or Wallace*

249. Microeconomics. Cost and supply considerations in price theory; the demand for factors of production. The allocation of resources in the context of competitive and monopolistic market structures. (Similar to Economics 149 but at a more advanced level; not open to students who have taken Economics 149.) 3 units. *Staff*

250S. Modern Economic Thought. Selective survey of themes in economic thinking since 1936, including the role of empirical work and of formalization. Prerequisites: Economics 149, 154, and Statistics 10D or consent of instructor. 3 units. *de Marchi or Weintraub*

251S. Regulation of Vice and Substance Abuse. Prerequisite: Economics 149 or Public Policy Studies 110. See C-L: Public Policy Studies 251S. 3 units. *Cook*

254. Macroeconomics. Concepts and measurement of national income and expenditures, employment, interest rates, and price levels; the theoretical determination of these aggregates; applications of macroeconomic theory to business cycles and economic growth. (Similar to Economics 154 but at a more advanced level; not open to students who have taken Economics 154.) 3 units. *Staff*

258. Financial Markets and Investments. The tools learned in microeconomics, macroeconomics, basic mathematics, and statistics applied to problems in financial economics. A blend of pure economic theory, an investigation of financial data, and practical applications using personal computers. Not open to students who have had Economics 158. Prerequisites: Economics 149, Economics 154, and a statistics course—preferably Statistics 110 or 210. 3 units. *Burmeister*

259S. State and Local Public Finance. Prerequisite: Public Policy Studies 217 or equivalent. See C-L: Public Policy Studies 259S. 3 units. *Ladd*

260. Economic Policy Analysis of Nonrenewable Resources. Prerequisite: Economics 149, Public Policy Studies 110, or Public Policy Studies 232. See C-L: Public Policy Studies 260. 3 units. *Conrad*

261. Evaluation of Public Expenditures. Not open to students who have taken Economics 285. See C-L: Public Policy Studies 261; also C-L: Environment 272. 3 units. *Conrad*

262S. Seminar in Applied Project Evaluation. Prerequisite: Economics 285 or Public Policy Studies 261. See C-L: Public Policy Studies 262S. 3 units. *Conrad*

265. International Trade and Finance. Fundamental principles of international economic relations. The economic basis for international specialization and trade, the economic gains from international trade and investment, the balance of payments, international finance, and the international monetary system. Prerequisites: Economics 149 and 154. 3 units. *Kimbrough, Krueger, and Tower*

266S. Current Issues in International Economics. Emphasis on individual research projects. Prerequisite: Economics 165, 265, or consent of instructor. 3 units. *Kimbrough, Krueger, or Tower*

269. Microeconomic Analysis. The basic tools for using microeconomic analysis to address practical economic problems. Topics include consumption, production, externalities, partial equilibrium, and general equilibrium. Applications drawn from labor markets, public goods, cost/benefit analysis, and optimal taxation. The level of the course is between intermediate microeconomics (Economics 149/249) and the core Ph.D. microeconomics sequence (Economics 301/302). 3 units. *Yang*

270L. Resource and Environmental Economics. Includes laboratory. Prerequisite: introductory course in microeconomics. See C-L: Environment 270L; also C-L: Public Policy Studies 272L. 4 units. *Kramer*

271. Behavioral and Experimental Economics. The relationship between actual behavior and economic models. Topics include individual decision-making behavior, game theory, and the role of market institutions. The interaction of economic and psychological theory. Students will have the opportunity to participate in, and conduct, economic experiments. (Same as Economics 171 but requires an additional paper; not open to students who have taken Economics 171.) Prerequisite: Economics 149 or consent of instructor. 3 units. *Staff*

272. Economic Analysis of Resource and Environmental Policies. Prerequisite: Environment 270L or equivalent; Economics 149 recommended. See C-L: Environment 271. 3 units. *Parks*

273. Economics of Organization and Management. Coordination and motivation issues within a corporation along with the internal design and dynamics of organizations. Topics include the structure of employment contracts, performance incentives, and the pricing of financial assets. (Same as Economics 173 but requires additional paper; not open to students who have taken Economics 173.) Prerequisite: Economics 149. 3 units. *Marshall or Meurer*

280S. Fundamentals of Political Economy. See C-L: Political Science 270S. 3 units. *Aldrich, Bates, or Bianco*

282S. Canada. See C-L: History 282S; also C-L: Cultural Anthropology 282S, Political Science 282S, and Sociology 282S. 3 units. *Cahow or Thompson*

286S. Economic Policy-Making in Developing Countries. See C-L: Public Policy Studies 286S. 3 units. *Conrad, Gillis, or Ramachandran*

287. Public Finance. Economic aspects of the allocative and distributive role of government in the economy, the incidence and efficiency of taxation, the effects of taxation on behavior, and analysis of major government spending programs. Not open to students who have had Economics 187. (Taught concurrently with Economics 187 but requires additional graduate-level work.) Prerequisite: Economics 149. 3 units. *Gentry*

288S. Current Issues in United States Federal Tax Policy. Evaluation of the equity and efficiency of United States tax policy. Topics include: (1) personal consumption versus income taxation and (2) restructuring the taxation of corporate income. Emphasis on the effects of taxes on savings, investment, and the international economy. Prerequisite: Economics 149 or consent of instructor. C-L: Public Policy Studies 288S. 3 units. *Gentry*

293. Soviet Economic History. From 1917 through the present. Foundations of the command economy—rejection of markets, central planning, industrialization, collectivization of agriculture; economic reforms and search for economic efficiency. Gorbachev's perestroika and the dissolution of the Soviet Union. 3 units. *Trembl*

294S. Soviet Economic System. Economic planning and administration in the Soviet Union. Theoretical and applied problems of resource allocation, economic development, and optimal micro decision making in a nonmarket economy. Gorbachev's perestroika, search for a new model, and the collapse of the Soviet system. 3 units. *Trembl*

For Graduates

301. Microeconomic Analysis I. Review of contemporary theory relating to consumer choice, production, the firm, and income distribution in competitive and im-

perfectly competitive markets. Restricted to Ph.D. students in Economics except with consent of instructor and Director of Graduate Studies. 3 units. *Marshall*

302. Microeconomic Analysis II. A continuation of Economics 301 with emphasis on analyses of consumer behavior, general equilibrium, welfare economics, and capital theory. Prerequisite: Economics 301. 3 units. *Graham*

303. Microeconomic Analysis III. A discussion of the formal models of economic justice with the tools of cooperative games and social choice. Topics include cost-sharing formulas, fair division, natural monopolies, public goods, collective preferences and utilities, and implementation theory. Prerequisites: Economics 301 and 302. 3 units. *Moulin*

304. Advanced Macroeconomics. Advanced topics in macroeconomics with some emphasis on computation and econometric analysis. Topics include real business cycle theory, endogenous growth theory, monetary theory, optimal monetary and fiscal policy and time consistency. 3 units. *Kimbrough*

305. Monetary Theory and Policy. Same topics as Economics 205S but with additional graduate level work. Prerequisite: Economics 304. 3 units. *Haorilesky*

309. Trade and Development Theory. Theory of international trade and trade policy as it affects the structure and growth of individual economies, with emphasis on developing countries. Comparative advantage, factor proportions explanation of trade, infant industry and other arguments for protection, interactions of exchange rate and trade policy, and special issues relating to primary commodities are examined. 3 units. *Krueger*

311, 312. History of Political Economy. A detailed review of the development of economic theory, the tools of economic analysis, and economics as a science, together with an analysis of the circumstances affecting this development. 3 units each. *Coats, de Marchi, Goodwin, or Weintraub*

313, 314. Seminar in Economic Theory. Prerequisite: Economics 301 or equivalent. 3 units each. *Weintraub*

315. Noncooperative Game Theory. A self-contained presentation of the main noncooperative concepts: dominant strategies, Nash equilibrium, subgame perfect equilibrium. Introduction to mixed and correlated strategies and the Bayesian equilibrium for games of incomplete information. Examples include oligopolistic competition, auctions, bargaining, and voting. C-L: Political Science 315 and Statistics 386. 3 units. *Meurer or Moulin*

316. Seminar in Economics of Soviet-Type Socialism. Selected topics in analysis of theoretical and institutional framework of Soviet economic system, such as markets versus plan, optimizing techniques in planning, price determination, balanced economic development, and ideology and economic policy. 3 units. *Trembl*

317. Development Economics I. Historical, empirical, and theoretical topics in development economics. 3 units. *Kelley*

318. Quantitative Development Economics. Selected topics in development economics with emphasis on empirical techniques. Topics include economic growth, income distribution, labor markets, human capital fertility, health, and their relationship with structural adjustment. 3 units. *Staff*

319. Seminar in the Theory and the Problems of Economic Growth and Change (Development Economics II). Links between aid, financial markets, and real investment in an open economy stressing tariff protection and capital controls (internal and exter-

nal). Economic policy-making using market solutions and/or planning models (input-output, linear programming, and computable general equilibrium). 3 units. *Krueger*

320. Macroeconomic Analysis I. Intertemporal models of consumption and labor supply; implications of these models for the behavior of macroeconomic aggregates, fiscal policy, and monetary policy; money demand and inflation; economic growth. Restricted to Ph.D. students in Economics except with consent of instructor and Director of Graduate Studies. 3 units. *Kimbrough*

322. Macroeconomic Analysis II. Further analysis of topics treated in Economics 320. Optimal economic growth; business cycles. Issues in economic policy. Prerequisite: Economics 320. 3 units. *Kimbrough*

326. Stochastic Macroeconomics. Advanced topics in macroeconomics with an emphasis on empirical macroeconomics and the interrelationship between economic theory and empirical work in macroeconomics. Topics include the interpretation of macroeconomic time series, formulating and testing models of asset pricing and market efficiency, solution and estimation of rational expectations models, vector autoregression models, and policy evaluation with empirical macroeconomic models. 3 units. *Bansal or Tauchen*

329. Public Economics I. Analysis of normative and positive models of the incidence and efficiency of taxation, and the effects of taxation on individual and firm behavior. 3 units. *Gentry*

330. Public Economics II. Public expenditure analysis including the analysis of externalities, benefit assessment, and risk and uncertainty. 3 units. *Viscusi*

355. Seminar in Labor Economics. 3 units. *Baumgardner or McElroy*

356. Graduate Health Economics I. Survey course designed for students considering Ph.D. research in health economics. Topics will include demand for health insurance, moral hazard, health as an investment, technological change, the principal-agent problem, occupational entry, and the supply of physician services. Prerequisites: Economics 243 and 301. 3 units. *Baumgardner or Sloan*

357. Seminar in Health Economics. Conceptual and empirical analysis of demand for health, medical services, and insurance; decisions by physicians and hospitals about price, quantity, and quality of services; technological change; and structure and performance of the pharmaceutical industry. Prerequisites: Economics 243 and 301. 3 units. *Baumgardner or Sloan*

358. Seminar in Labor Market and Related Analysis. A survey of several topics in modern labor economics including human capital, signaling, static and dynamic labor supply, household production, labor contracts, search, the theory of equalizing differences, and discrimination. 3 units. *Baumgardner*

359. Economic Analysis of Legal Issues. An exploration of diverse topics in law and economics such as property rights and externalities, tort law and optimal accident prevention, bargaining and game theory, the economics of contracts, and theories of economic justice. 3 units. *Culp or Meurer*

365. Seminar in International Trade Theory and Policy. 3 units. *Krueger or Tower*

366. Seminar in International Monetary Theory. 3 units. *Kimbrough*

380. Graduate Economics Workshops. May be taken for multiple credit. Sections: .01 Industrial Organization and Regulation; .02 International Economics; .03 Labor Economics; .04 Macroeconomics; .05 Public Finance; .06 Economic Thought; .07 Corpo-

rate Economics; .08 Econometrics; .09 Economic Theory. 3 units each. Variable credit. *Staff*

388. Industrial Organization. Analysis of models of markets, especially oligopoly. Game theoretic models of entry deterrence and predation. Product selection and advertising and other selected topics. 3 units. *Grabowski, Marshall, Meurer, or Vernon*

389. Seminar in Industrial and Governmental Problems. Criteria for evaluating industrial performance. Antitrust, policy toward innovation, natural monopoly regulation, and regulation of selected industries. 3 units. *Grabowski, Marshall, or Vernon*

397, 398. Directed Research. 3 units each. *Staff*

COURSES CURRENTLY UNSCHEDULED

231S. Economic Development in Latin America

235. The Economics of Crime

248. Advanced Theory and Methods in Econometrics

307. Quantitative Analysis I

308. Quantitative Analysis II

321. Theory of Quantitative Economic Policy

323. Income Distribution Theory

324, 325. Economics of the Law

345, 346. Demographic Techniques I and II

401. Seminar on the British Commonwealth

402. Interdisciplinary Seminar in the History of the Social Sciences

RELATED COURSES IN OTHER DEPARTMENTS

Courses in related fields may be selected from anthropology, computer science, environmental studies, history, mathematics, philosophy, political science, public policy sciences, sociology, and statistics or from an area that complements the candidate's area of research interests in economics.

See the Center for Demographic Studies in the chapter "Special and Cooperative Programs" for further information.

Engineering

Earl H. Dowell, Sc.D., *Dean* (305 Teer Engineering Library Building); Charles P. Yohn, B.S.E., *Associate Dean, Director of Development* (305 Teer Engineering Library Building)

The School of Engineering offers programs of study and research leading to the M.S. and Ph.D. degrees with a major in biochemical, biomedical, civil and environmental, electrical, and mechanical engineering and materials science. These programs are designed to provide: (1) development of depth and breadth in mathematics, computer science, the basic physical sciences, the life sciences where appropriate, and the engineering sciences; (2) mastery of an advanced body of knowledge in the candidate's chosen field of specialization or research; (3) experience in the art of engineering, including strong elements of intuition, imagination, and judgment; and (4) performance of original research which, in the case of the M.S. degree, demonstrates the ability to advance knowledge in the area of professional study and, in the case of the Ph.D. degree, makes a significant contribution to the research literature through publication in a

leading professional journal in the field. Engineering graduate students are expected to participate in seminars appropriate to their fields of study. A minimum of 30 units of earned graduate credit beyond the bachelor's degree is required for the M.S. degree: 12 in the major, 6 in related minor work (usually mathematics or natural science), 6 in either the major or minor subject or in other areas approved by the major department, and 6 for a research-based thesis. A nonthesis option requiring 30 units of course credit is available. Each of the departments imposes additional requirements in the exercise of this option. There is no language requirement for this degree. A minimum of 60 units of earned graduate credit beyond the bachelor's degree is required for the Ph.D. degree. In civil and environmental engineering, 12 units of course work beyond the master's degree are required to be in the major field, 6 in a related minor field, and 6 in either the major or minor field; in electrical engineering, 24 units are required in the major field and 12 units in a related minor field (often mathematics or natural science), 12 in either the major or minor subject or other areas approved by the major department, and 12 for a research-based dissertation. In biomedical and mechanical engineering and materials science there are no specific course requirements; each program is planned to meet individual needs. Doctoral students are required to pass qualifying and preliminary examinations which may be either written, oral, or a combination of written and oral components, at the discretion of the committee and the department.

In addition, the School of Engineering and the Fuqua School of Business offer an MBA/MS Joint-Degree Program. Further details about this program may be obtained from: Professor Miguel Medina, Director, MBA/MS Joint-Degree Program, Department of Civil and Environmental Engineering.

ENGINEERING

221. Computational Linear Algebra. Linear vector spaces of real and complex n -tuples, norms, metrics, inner-products, basis vectors, rank and dimensionality; matrices as linear maps, rank and nullity, particular and general solutions of $Ax=b$; factorization of matrices by successive transformations; solution of $Ax=b$ by direct and iterative methods; special and general eigenvalue problems; diagonalization and tridiagonalization by similarity transformations; power methods, computational complexities, storage requirements, convergence characteristics, error propagation, and the mathematical basis of the studied algorithms. Prerequisites: Mathematics 111 or equivalent, and knowledge of any algorithmic programming language. 3 units. *S. Ulku*

COURSES CURRENTLY UNSCHEDULED

222. Computer Solutions of Ordinary and Partial Differential Equations

Biomedical Engineering

Professor McElhaney, *Chair* (136 Engineering); Professor von Ramm, *Director of Graduate Studies* (267 Engineering Annex); Professors Barr, Clark, Hammond, Jaszczak, Nolte, Plonsey, and Wolbarsht; Associate Professors Burdick, Floyd, Pasipoularides, Reichert, S. Smith, and Trahey; Assistant Professors Cusma, Henriquez, Jacobs, Krassowska, Myers, and Truskey

Biomedical engineering is the discipline in which the physical, mathematical, and engineering sciences and associated technology are applied to biology and medicine. Contributions range from modeling and simulation of physiological systems through experimental research to solutions of practical clinical problems. The goal of the graduate program in biomedical engineering is to combine training in advanced engineering, biomedical engineering, and the life sciences so that graduates of the program can contribute at the most advanced professional level. The doctoral dissertation should demonstrate significant and original contributions to an interdisciplinary topic, accomplished as an independent investigator. The major, current research areas are: biochem-

ical engineering, biofluid mechanics, biomechanics, biomedical materials, biomedical modeling, biosensors, biotechnology, data acquisition and processing, medical imaging, and electrophysiology. Every biomedical engineering graduate student is required to serve as a teaching assistant as part of the graduate training.

201L. Electrophysiology. The electrophysiology of excitable cells from a quantitative perspective. Topics include the ionic basis of action potentials, the Hodgkin-Huxley model, impulse propagation, source-field relationships, and an introduction to functional electrical stimulation. Students choose a relevant topic area for detailed study and report. Not open to students who have taken Biomedical Engineering 101 or equivalent. 3 units; 4 units with laboratory. Variable credit. *Barr or Henriquez*

205L. Microprocessors and Digital Instruments. Design of microcomputer-based devices including both hardware and software considerations of system design. Primary emphasis on hardware aspects, including a progression through initial design, prototype construction in the laboratory, testing of prototypes to locate and correct faults, and final design evaluation. Evaluation includes examination of complexity, reliability, and cost. Design and construction oriented toward biomedical devices or instruments that include dedicated microcomputers, usually operating in real time. Prerequisites: Engineering 51L and Biomedical Engineering 163L, 164L or equivalents. 4 units. *Barr or Hammond*

207. Transport Phenomena in Biological Systems. See C-L: Biochemical Engineering 207; also C-L: Civil Engineering 207 and Mechanical Engineering 207. 3 units. *Truskey*

209. Kinetics and Reactor Design. Prerequisite: Mathematics 111 or consent of instructor. See C-L: Biochemical Engineering 209; also C-L: Civil Engineering 209. 3 units. *Staff*

211. Theoretical Electrophysiology. Advanced topics on the electrophysiological behavior of nerve and striated muscle. Source-field models for single-fiber and fiber bundles lying in a volume conductor. Forward and inverse models for EMG and ENG. Bidomain model. Model and simulation for stimulation of single-fiber and fiber bundle. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. Prerequisite: Biomedical Engineering 101 or 201 or equivalent. 4 units. *Barr or Plonsey*

212. Theoretical Electrocardiography. Electrophysiological behavior of cardiac muscle. Emphasis on quantitative study of cardiac tissue with respect to propagation and the evaluation of sources. Effect of junctions, inhomogeneities, anisotropy, and presence of unbounded extracellular space. Bidomain models. Study of models of arrhythmia, fibrillation, and defibrillation. Electrocardiographic models and forward simulations. Laboratory exercises based on computer simulation, with emphasis on quantitative behavior and design. Readings from original literature. Prerequisite: Biomedical Engineering 101 or 201 or equivalent. 4 units. *Barr or Plonsey*

215. Biomedical Materials and Artificial Organs. Chemical structures, processing methods, evaluation procedures, and regulations for materials used in biomedical applications. Applications include implant materials, components of ex vivo circuits, and cosmetic prostheses. Primary emphasis on polymer-based materials and on optimization of parameters of materials which determine their utility in applications such as artificial kidney membranes and artificial arteries. Prerequisite: Engineering 83L or Chemistry 151L or consent of instructor. C-L: Mechanical Engineering 215. 3 units. *Clark or Reichart*

216. Transport Phenomena in Cells and Organs. Prerequisite: Biomedical Engineering 207 or equivalent. See C-L: Biochemical Engineering 216. 3 units. *Truskey*

222. Principles of Ultrasound Imaging. Propagation, reflection, refraction, and diffraction of acoustic waves in biologic media. Topics include geometric optics, physical optics, attenuation, and image quality parameters such as signal-to-noise ratio, dynamic range, and resolution. Emphasis is placed on the design and analysis of medical ultrasound imaging systems. Prerequisites: Physics 52L and Mathematics 111. 3 units. *von Ramm*

223. Cellular and Integrative Cardiovascular Physiology and Biophysics. Electrical and mechanical properties of the heart at the cellular and organ levels; reflex control of cardiac output; the heart as an endocrine organ; interaction between heart, kidney, and lung; comparative cardiac physiology. Prerequisites: Cell Biology 203 or equivalent and Physics 52L or equivalent; consent of instructor or graduate status. C-L: Cell Biology 223. 3 units. *Benjamin and staff*

230. Biomechanics. Kinematic models of human motions, mechanical properties of bone and soft tissues, load directed growth mechanisms, human tolerance to impact and vibration, head injury criteria applied to helmet design. 3 units. *McElhaney*

231. Orthopaedic Biomechanics. Biomechanics of hard and soft tissues: nonlinear viscoelastic behavior of tendon and ligament; poroelastic behavior of cartilage and meniscus; continuum modeling of bone. Emphasis will be placed on experimental techniques used to evaluate these tissues. Student seminars on topics in applied biomechanics will be included. Prerequisites: Biomedical Engineering 110L or Engineering 75L or equivalent, and Biomedical Engineering 83 or Engineering 83L or equivalent. 3 units. *Myers*

233. Modern Diagnostic Imaging Systems. The underlying concepts and instrumentation of several modern medical imaging modalities. Review of applicable linear systems theory and relevant principles of physics. Modalities studied include X-ray radiography (conventional film-screen imaging and modern electronic imaging), computerized tomography (including the theory of reconstruction), and nuclear magnetic resonance imaging. Consent of instructor required. 3 units. *Cusma or Floyd*

235. Acoustics and Hearing. The generation and propagation of acoustic (vibrational) waves and their reception and interpretation by the auditory system. Topics under the heading of generation and propagation include free and forced vibrations of discrete and continuous systems, resonance and damping, and the wave equation and solutions. So that students may understand the reception and interpretation of sound, the anatomy and physiology of the mammalian auditory system are presented; and the mechanics of the middle and inner ears are studied. Prerequisites: Physics 52L and Mathematics 111 or equivalents. 3 units. *Trahey*

237. Biosensors. Biosensors defined as the use of biospecific recognition mechanisms in the detection of analyte concentration. The basic principles of protein binding with specific reference to enzyme-substrate, lectin-sugar, antibody-antigen, and receptor-transmitting binding. Simple surface diffusion and absorption physics at surfaces with particular attention paid to surface binding phenomena. Optical, electrochemical, gravimetric, and thermal transduction mechanisms which form the basis of the sensor design. Prerequisites: Biomedical Engineering 215 and consent of instructor. C-L: Biochemical Engineering 237. 3 units. *Reichert*

241. Artificial Intelligence in Medicine. Basic concepts of artificial intelligence (AI) and in-depth examination of medical applications of AI. Knowledge of heuristic programming; brief examination of classic AI programming languages (LISP and PROLOG) and AI programming; rule-based systems and cognitive models. 3 units. *Hammond*

244. Mathematical Models of Physiological Systems. Mathematical modeling and computer simulation of physiological and other biomedical systems. Formula-

tion of quantitative models of physiological processes using methods drawn from a variety of engineering disciplines including transport phenomena, feedback control, and continuum mechanics. Digital techniques for the solution of coupled nonlinear equations, emphasizing systems of ordinary and partial differential equations. Selected readings from the literature covering current models of cardiovascular, renal, neural, respiratory, and sensory systems. Prerequisite: Mathematics 111 or equivalent. 3 units. *Pasipoularides*

250. Cardiovascular Mechanics. Mechanical principles and their applications in the human circulatory system. The coupling of solid and fluid behavior in cardiovascular organs is emphasized. Topics include: gravity and the circulation, kinematics of blood flow and circulatory volume balances, peripheral resistance, wall stresses and deformations, cardiac cycle and cardiac work, circulatory wave propagation, unsteady velocity profiles and boundary layers. Special student projects involve the design of diagnostic and therapeutic instruments and devices for cardiovascular applications. Prerequisites: Biomedical Engineering 110 and Mathematics 111 or equivalent. 3 units. *Pasipoularides*

255. Safety of Medical Devices. Safety of medical devices such as prosthetic heart valves and silicone breast implants. Engineering analysis of the safety of biomedical instrumentation in the context of the regulations of the U.S. Food and Drug Administration. Engineering performance standards and FDA requirements for clinical trials for selected medical devices such as medical diagnostic ultrasound, surgical lasers, and prosthetic heart valves. Students will prepare a mock application for FDA premarket approval to demonstrate safety of a selected medical device. Prerequisite: Biomedical Engineering 164L or equivalent or consent of instructor. 3 units. *S. Smith*

264. Medical Instrument Design. General principles of signal acquisition, amplification processing, recording, and display in medical instruments. System design, construction, and evaluation techniques will be emphasized. Methods of real-time signal processing will be reviewed and implemented in the laboratory. Each student will design, construct, and demonstrate a functional medical instrument and collect and analyze data with that instrument. Formal write-ups and presentations of each project will be required. Prerequisite: Biomedical Engineering 164 or equivalent or senior standing. 3 units. *Trahey*

265. Advanced Topics in Biomedical Engineering. Advanced subjects related to programs within biomedical engineering tailored to fit the requirements of a small group. Consent of instructor required. Variable credit. *Staff*

For Graduates

320. Medical Ultrasound Transducers. A study of the design, fabrication and evaluation of medical ultrasound transducers. Topics include wave propagation in piezoelectric crystals, Mason and KLM circuit models, linear arrays and two-dimensional arrays, piezoelectric ceramic/epoxy composite materials, piezoelectric polymers, and photo-acoustic materials. Consent of instructor required. 3 units. *S. Smith*

330. Finite Element Method for Biomedical Engineers. The finite element method with an emphasis on applications to biomedical engineering. Several detailed examples illustrate the finite element analysis process, which includes setting up a mathematical description of the problem, putting it into a form suitable for finite element solution, solving the discretized problem, and using advanced computer codes to check the correctness of the numerical results. Consent of instructor required. 3 units. *Staff*

333. Biomedical Imaging. A study of the fundamentals of information detection, processing, and presentation associated with imaging in biology and medicine. Analysis of coherent and incoherent radiation and various image generation techniques. Design and analysis of modern array imaging systems as well as systems. 3 units. *von Ramm*

399. Special Readings in Biomedical Engineering. Individual readings in advanced study and research areas of biomedical engineering. Approval of director of graduate studies required. 1 to 3 units each. Variable credit. *Staff*

COURSES CURRENTLY UNSCHEDULED

202. Biomedical Transfer Processes

204. Measurement and Control of Cardiac Electrical Events

206L. Microprocessors and Digital Instruments

243. Introduction to Medical Informatics

311. Inverse Models

Civil and Environmental Engineering

Professor Petroski, *Chair* (121 Engineering); Associate Professor Peirce, *Director of Graduate Studies* (139A Engineering); Professors Haff, Melosh, S. Utku, Vesilind, and J. F. Wilson; Associate Professors Hueckel, Medina, Pas, and Reckhow; Assistant Professors Faust, Jacobs, Laursen, and Virgin; Professor Emeritus Brown; Research Associate Professor Biswas; Adjunct Associate Professor B. Utku

Civil and environmental engineering extends across mathematics, the natural sciences including physics, biology, and chemistry, and the social and management sciences. Civil and environmental engineers develop expertise in these disciplines to research, plan, design, construct, and analyze solutions to technical problems faced throughout society. These solutions vary widely in nature, size, and scope: space satellites and launching facilities, environmental systems and controls to protect public health, nuclear and conventional power generators, bridges, dams, buildings, tunnels, highways, and mass transportation systems.

Six major specialty areas at Duke enjoy national and international reputations for quality

- engineering mechanics: the study of the behavior of solid and fluid systems under a broad range of design and extreme loading conditions; the development of new computational paradigms for complex mechanical systems;
- environmental engineering: the study of the disposal of hazardous waste, solid waste processing, pollutant fate and transport in water, soil, and air, biotechnology, and water and wastewater treatment to protect public health and the environment;
- geomechanics: the study of the response of soils and rocks to mechanical, hydraulic, and environmental loadings and its mathematical modeling;
- structural engineering: the study of behavior of structures and materials, the safe and economical design of engineered structures, fundamentals of adaptive structures, use of adaptive structures technology in precision and vibration control of space structures, and vibration inhibition in buildings subjected to seismic and wind excitations;
- transportation and systems engineering: the modeling and analysis of large and complex mechanical, environmental, and human systems to support decision making and policy analysis, complex decision making, pattern formation, and nonlinearity using computer simulation;
- water resources engineering: the analysis of use, preservation, and management of surface and groundwater supplies.

Environmental mechanics is as an interdisciplinary area of interest to many of our faculty. The emphasis is on mechanics of chemically and/or biologically interacting solids and liquids, including transport phenomena in porous media, environmental geomechanics, degradation and aging of structures and materials due to chemically

aggressive environments, and natural and engineered environmental processes including sedimentation, coagulation, mixing, sludge processing, water and wastewater treatment, and barriers to prevent pollutant transport.

Laboratory facilities in the department are competitive with those found in major research universities worldwide. Computers are used for data collection and analysis, and a wide range of physical, chemical, and biological testing equipment is used in the laboratory for teaching and research activities. Advanced-graphics computer systems are also available. Project-specific measurement equipment is designed, constructed, and applied in many of the specialty areas mentioned above.

Under the Reciprocal Agreement with Neighboring Universities, a student may enroll in classes offered by the University of North Carolina at Chapel Hill and North Carolina State University in Raleigh. Although related work normally is taken in the natural sciences, computer sciences, or mathematics, a student with interests in the social or management sciences may take relevant work in these areas.

201. Advanced Mechanics of Solids. Tensor fields and index notation. Analysis of states of stress and strain. Conservation laws and field equations. Constitutive equations for elastic, viscoelastic, and elastic-plastic solids. Formulation and solution of simple problems in elasticity, viscoelasticity, and plasticity. 3 units. *Hueckel, Laursen, or Petroski*

203. Plasticity. Inelastic behavior of soils and engineering materials. Yield criteria. Flow rules. Concepts of perfect plasticity and plastic hardening. Methods of rigid-plasticity. Limit analysis. Isotropic and kinematic hardening. Plastic softening. Diffused damage. Thermo-plasticity. Visco-plasticity. Prerequisite: Civil Engineering 201 or consent of instructor. 3 units. *Hueckel*

204. Plates and Shells. Differential equation and extremum formulations of linear equilibrium problems of Kirchhoffian and non-Kirchhoffian plates of isotropic and orthotropic material. Solution methods. Differential equation formulation of thin shell problems in curvilinear coordinates; membrane and bending theories; specialization for shallow shells, shells of revolution, and plates. Extremum formulation of shell problems. Solution methods. Prerequisites: Engineering 75L or 135 and Mathematics 111. 3 units. *Utku*

205. Elasticity. Introduction to linear theory of elasticity. Constitutive equations for anisotropic and isotropic elastic solids. Formulation and solution of torsion, bending, and flexure problems. Plane, axisymmetric, and three-dimensional problems. 3 units. *Petroski*

207. Transport Phenomena in Biological Systems. See C-L: Biochemical Engineering 207; also C-L: Biomedical Engineering 207 and Mechanical Engineering 207. 3 units. *Truskey*

209. Kinetics and Reactor Design. Prerequisite: Mathematics 111 or consent of instructor. See C-L: Biochemical Engineering 209; also C-L: Biomedical Engineering 209. 3 units. *Staff*

210. Intermediate Dynamics. See C-L: Mechanical Engineering 210. 3 units. *Virgin*

215. Engineering Systems Analysis. Fundamental concepts and tools for engineering systems analysis, including optimization techniques and decision analysis. System definition and model formulation, optimization by calculus, linear programming, integer programming, separable integer programming, nonlinear programming, network analysis, dynamic programming, and decision analysis. Application to diverse engineering systems. 3 units. *Pas*

217. Transportation Systems Analysis. The transportation systems planning process. Quantitative analysis; mathematical modeling and computer simulation techniques for short-and long-range planning and evaluation of transportation systems. Prerequisite: (or corequisite) Civil Engineering 116 or consent of instructor. 3 units. *Pas*

218. Engineering Management and Project Evaluation. Statistical analysis and economics. Data organization, distributions, estimates of parameters, hypothesis testing, analysis of variance, experimental design. Economic impact assessment, supply and demand forecasting, benefit/cost analysis, economic incentives, public and private finance, input/output analysis. 3 units. *Peirce*

221. Engineering Systems Reliability, Safety, and Risk Assessment. Introduction to the concepts of design reliability and safety. Topics include: concepts of probability in engineering planning and design, decision analysis and assessment of reliability, modeling and analysis of uncertainty, reliability-based design, multiple failure mode analysis, redundant and nonredundant systems, and fault tree analysis. Emphasis on determining the probability of failure for numerous engineering systems including structural systems, infrastructure systems, water treatment systems, environmental systems, and transportation networks. Prerequisite: Mathematics 111 or consent of instructor. 3 units. *Jacobs*

225. Dynamic Engineering Hydrology. Dynamics of the occurrence, circulation, and distribution of water; climate, hydrometeorology, geophysical fluid motions. Precipitation, surface runoff and stream flow, infiltration, water losses. Hydrograph analysis, catchment characteristics, hydrologic instrumentation, and computer simulation models. Prerequisite: Civil Engineering 122L or consent of instructor. 3 units. *Medina*

227. Groundwater Hydrology and Contaminant Transport. Review of surface hydrology and its interaction with groundwater. The nature of porous media, hydraulic conductivity, and permeability. General hydrodynamic equations of flow in isotropic and anisotropic media. Water quality standards and contaminant transport processes: advective-dispersive equation for solute transport in saturated porous media. Analytical and numerical methods, selected computer applications. Deterministic versus stochastic models. Applications: leachate from sanitary landfills, industrial lagoons and ponds, subsurface wastewater injection, monitoring of groundwater contamination. Conjunctive surface-subsurface models. Prerequisite: Civil Engineering 123L or consent of instructor. 3 units. *Medina*

228L. Sludge Management and Disposal. The analysis and design of sludge production processes in water and wastewater treatment plants. Sludge thickening, dewatering, drying, incineration, and ultimate disposal. Legal and regulatory restrictions and concerns. Prerequisite: Civil Engineering 124L or consent of instructor. 3 units. *Vesilind*

233. Prestressed Concrete Design. A critical review of research and recent developments in prestressed concrete design. Prestressed tanks, beams, and columns; partial prestressing and composite design. Prerequisite: Civil Engineering 133L. 3 units. *Biswas*

237. Advanced Soil Mechanics. Characterization of behavior of geomaterials. Stress-strain incremental laws. Nonlinear elasticity, hypo-elasticity, plasticity and viscoplasticity of geomaterials; approximated laws of soil mechanics; fluid-saturated soil behavior; cyclic behavior of soils; liquefaction and cyclic mobility; elements of soil dynamics; thermal effects on soils. Prerequisite: Civil Engineering 139L or equivalent. 3 units. *Hueckel*

240. Fate of Organic Chemicals in the Environment. Kinetic, equilibrium, and analytical approaches applied to quantitative description of processes affecting the fate of anthropogenic and natural organic compounds in ground, surface, and atmospheric waters and in selected treatment processes, including sorption phenomena, gas transfer, hydrolysis, photochemistry, oxidation-reduction, and biodegradation. Sampling, detection, identification, and quantification of organic compounds in the environment. Gas and liquid chromatology and mass spectrometry. Prerequisite: (or corequisite) Civil Engineering 242/Environment 242 or equivalent. C-L: Environment 240. 3 units. *Dubay and Faust*

242. Environmental Chemistry. Principles of chemical kinetics and equilibria applied to quantitative description of the chemistry of lakes, rivers, oceans, atmospheric waters, groundwaters, and selected treatment processes. Equilibrium, steady state, and other kinetic models applied to processes such as the carbonate system, coordination chemistry, precipitation and dissolution, oxidation-reduction, photochemistry, heterogeneous reactions, gas transfer, and some aspects of atmospheric chemistry. C-L: Environment 242. 3 units. *Faust*

243. Physicochemical Unit Operations in Water Treatment. Fundamental bases for design of water and waste treatment systems, including transport, mixing, sedimentation and filtration, gas transfer, coagulation, and absorption processes. Emphasis on physical and chemical treatment combinations for drinking water supply. Prerequisite: Engineering 24L or Civil Engineering 124L. 3 units. *Vesilind*

244. Applied Microbial Processes. Consent of instructor required. See C-L: Biochemical Engineering 244. 3 units. *Staff*

245. Pollutant Transport Systems. Distribution of pollutants in natural waters and the atmosphere; diffusive and advective transport phenomena within the natural environment and through artificial conduits and storage/treatment systems. Analytical and numerical prediction methods. Prerequisites: Civil Engineering 122L and Mathematics 111 or equivalents. 3 units. *Medina*

246. Water Supply Engineering Design. The study of water resources and municipal water requirements including reservoirs, transmission, treatment and distribution systems; methods of collection, treatment, and disposal of municipal and industrial wastewaters. The course includes the preparation of a comprehensive engineering report encompassing all aspects of municipal water and wastewater systems. Field trips to be arranged. Prerequisite: Engineering 24L or Civil Engineering 124L or consent of instructor. 3 units. *Vesilind*

248. Solid Waste and Resource Recovery Engineering. Engineering design of resource recovery systems including traditional and advanced technologies. Sanitary landfills and incineration of solid wastes. Energy recovery and recycling processes. Application of systems analysis to collection of municipal refuse. Collection, treatment, and disposal of solid wastes from wastewater treatment. Prerequisite: Engineering 24L or Civil Engineering 124L. 3 units. *Vesilind*

249. Control of Hazardous and Toxic Waste. Engineering solutions to industrial and municipal hazardous waste management problems. Handling, transportation, storage, and disposal technologies. Biological, chemical, and physical processes. Upgrading an abandoned disposal site. Economic and regulatory aspects. Case studies. Consent of instructor required. 3 units. *Peirce*

251. Systematic Engineering Analysis. Mathematical formulation and numerical analysis of engineering systems with emphasis on theory of structures. Equilibrium and eigenvalue problems in continuum and in discrete space; properties of these systems and discretization of systems in continuum by the trial functions with undetermined

parameters. The use of weighted residual methods, finite elements, and finite differences. Prerequisite: senior or graduate standing. 3 units. *S. Utku*

252. Buckling of Engineering Structures. An introduction to the underlying concepts of elastic stability and buckling, development of classical (differential equation) and modern (energy) approaches, buckling of common engineering components including link models, struts, frames, plates, and shells. Consideration will also be given to inelastic behavior, postbuckling, and design implications. Prerequisite: Civil Engineering 131L or consent of instructor. C-L: Mechanical Engineering 252. 3 units. *Biswas or Virgin*

254. Applications of Finite Element Analysis. Theory of element and material models; models of metals, rock, reinforced concrete, wood, glass, soil, water, and air; analyses of torsion members, shear walls, membranes, plates, shells, solids, and compound structural systems; analysis of soil-structure and fluid-structure systems; prediction of field heating, seepage, and pollution. Prerequisite: Civil Engineering 251 or consent of instructor. 3 units. *Staff*

257. Structural Optimization. Computer-aided improvement of structural designs; redesign search processes, sensitivity analysis, integrity analysis; optimization of static, steady-state, and transient response systems; minimization of structural weight and response potentials for trusses, frames, and continua. 3 units. *Staff*

265. Advanced Topics in Civil and Environmental Engineering. Opportunity for study of advanced subjects relating to programs within the civil and environmental engineering department tailored to fit the requirements of individuals or small groups. Variable credit. *Staff*

281. Experimental Systems. Formulation of experiments; Pi theorem and principles of similitude; data acquisition systems; static and dynamic measurement of displacement, force, and strain; interfacing experiments with digital computers for data storage, analysis, and plotting. Students select, design, perform, and interpret laboratory-scale experiments involving structures and basic material behavior. Prerequisite: senior or graduate standing in engineering or the physical sciences. 3 units. *J. F. Wilson*

283. Structural Dynamics. Formulation of dynamic models for discrete and continuous structures, normal mode analysis, deterministic and stochastic responses to shocks and environmental loading (earthquakes, winds, and waves), introduction to nonlinear dynamic systems, analysis and stability of structural components (beams and cables and large systems such as offshore towers, moored ships, and floating platforms). 3 units. *J. F. Wilson*

301, 302. Fall and Spring Seminars. Current topics in civil and environmental engineering theory and practice. Weekly seminar series. No credit. *Peirce*

399. Special Readings in Civil and Environmental Engineering. Special individual readings in a specific area of study in civil and environmental engineering. Approval of director of graduate studies required. 1 to 3 units. Variable credit. *Graduate faculty*

COURSES CURRENTLY UNSCHEDULED

202. Advanced Mechanics of Solids II

212. Mechanical Behavior and Fracture of Materials

216. Transportation Planning and Policy Analysis

222. Open Channel Flow

223. Flow Through Porous Media

- 226. Operational Hydrology
- 231. Structural Engineering Analysis
- 232. Reinforced Concrete Design
- 234. Advanced Structural Design in Metals
- 235. Foundation Engineering
- 236. Earth Structures
- 238. Rock Mechanics
- 239. Physical Properties of Soils
- 247. Air Pollution Control
- 258. Analysis of Dynamic and Nonlinear Behavior of Structures
- 337. Elements of Soil Dynamics
- 350. Advanced Engineering Analysis

Electrical Engineering

Professor Casey, *Chair* (130 Engineering); Professor Nolte, *Director of Graduate Studies* (172 Engineering); Professors Fair, Gelenbe, Joines, Marinos, Trivedi, Wang, and T. G. Wilson; Associate Professors Alexandrou, Dugan, Kedem, Krolik, and Massoud; Assistant Professors Board, Daniels-Race, Dollas, George, Hansen, Teitsworth, and Overhauser; Professor Emeritus Owen; Assistant Research Professor Ybarra; Adjunct Professors Glomb, Lontz, and Strosio; Adjunct Associate Professor Kanopoulos; Adjunct Associate Professor Derby; Adjunct Assistant Professors Bottomley, Goodwin-Johansson, Loeb, Spano, and Strole; Visiting Professors Iafrate and McCumber

A student may specialize in any one of the following fields in working toward either the M.S. or the Ph.D. degree with a major in electrical engineering: computer engineering, computer architecture, fault-tolerant computer systems, scientific computing, parallel processing, VLSI CAD tools, signal processing, digital speech processing, signal detection and estimation, ocean acoustic signal processing, image processing, solid-state electronics, integrated circuit processing and process simulation, molecular-beam epitaxy, III-V compound semiconductor materials and devices, machine intelligence, application of electromagnetic fields and waves, power electronics and magnetics. Recommended prerequisites for the graduate courses in electrical engineering include a knowledge of basic mathematics and physics, electrical networks, and system theory. Students in doubt about their background for enrollment in specific courses should discuss the matter with the director of graduate studies. The M.S. degree program includes either a thesis or a project and an oral examination. A qualifying examination is required for the Ph.D. degree program. This examination is intended to test both the breadth and depth of the student's understanding of basic electrical engineering concepts. There is no foreign language requirement.

211. Quantum Mechanics. Discussion of wave mechanics including elementary applications, free particle dynamics, Schrödinger equation including treatment of systems with exact solutions, and approximate methods for time-dependent quantum mechanical systems with emphasis on quantum phenomena underlying solid-state electronics and physics. Prerequisite: Mathematics 111 or equivalent. 3 units. *Staff*

214. Introduction to Solid-State Physics. Discussion of solid-state phenomena including crystalline structures, x-ray and particle diffraction in crystals, lattice dynamics, free electron theory of metals, energy bands, and superconductivity, with emphasis

on understanding electrical and optical properties of solids. Prerequisite: quantum physics at the level of Physics 143L or Electrical Engineering 211. C-L: Physics 214. 3 units. *Teitsworth*

215. Semiconductor Physics. A quantitative treatment of the physical processes that underlie semiconductor device operation. Topics include band theory and conduction phenomena; equilibrium and nonequilibrium charge carrier distributions; charge generation, injection, and recombination; drift and diffusion processes. Prerequisite: Electrical Engineering 211 or consent of instructor. 3 units. *Daniels-Race*

216. Devices for Integrated Circuits. Derivation of basic semiconductor properties such as the effective mass, effective density of states, SHR recombination, avalanche breakdown and energy-band diagrams. Application of the continuity equation, Gauss' law, and Poisson's equation to obtain the I-V and C-V behavior of Si and GaAs Schottky barriers, GaAs MESFETs; Si JFETs, bipolar transistors and MOSFETs. Relation of device physics to SPICE parameters. Four laboratory exercises. 3 units. *Casey*

217. Analog Integrated Circuits. Analysis and design of analog integrated circuits. Bipolar and MOSFET circuits. SPICE models. Elementary integrated amplifier circuits, performance of operational amplifiers and other analog circuits including frequency response and noise. A/D converters and switched capacitor filters. Prerequisite: Electrical Engineering 216. 3 units. *Staff*

218. Integrated Circuit Engineering. Basic processing techniques and layout technology for integrated circuits. Photolithography, diffusion, oxidation, ion implantation, and metallization. Design, fabrication, and testing of integrated circuits. Prerequisite: Electrical Engineering 216. 3 units. *Fair*

219. Digital Integrated Circuits. Analysis and design of digital integrated circuits. MOSFET and bipolar devices. SPICE models. Major logic families such as NMOS, CMOS, TTL, ECL, and I^2L as well as regenerative logic circuits and memories. Circuit design considerations for VLSI. Prerequisites: Electrical Engineering 151 and 216. 3 units. *Massoud*

243. Pattern Classification and Recognition. Parameter estimation and supervised learning, nonparametric techniques, linear discriminant functions, clustering, language theory related to pattern recognition, examples from areas such as character and severe weather recognition, classification of community health data, recognition of geometrical configurations, algorithms for recognizing low resolution touch-sensor array signatures and 3-D objects. Consent of instructor required. 3 units. *Wang*

245. Digital Control Systems. Review of traditional techniques used for the design of discrete-time control systems; introduction of "nonclassical" control problems of intelligent machines such as robots. Limitations of the assumptions required by traditional design and analysis tools used in automatic control. Consent of instructor required. 3 units. *Myers*

251. Advanced Digital System Design. Theory and hands-on experience in advanced digital system design. High-speed design, high complexity design (more than 10,000 gates), implementation technology selection, system modeling, power and clock distribution, line termination, and cooling. Case studies and demonstrations. Extensive use of CAD tools for logic minimization, logic synthesis, and system simulation. Rapid system prototyping with off-the-shelf and custom components. Laboratory exercises and a semester project. Prerequisites: Electrical Engineering 151 and 161. 3 units. *Dollas*

252. Advanced Digital Computer Architecture. A second course on computer architecture. Definition of high-performance computing. The von Neumann bottleneck, Amdahl's law. Computer taxonomies. Memory organization, Princeton/Harvard archi-

tructures, caches, and virtual memory. Instruction pipelining. Vector processing. Instruction sets (RISC/CISC/VLIW). Parallel processing (SIMD/MIMD). Multiprocessor interconnection networks, communications, and synchronization. Prerequisite: Computer Science 104 or Electrical Engineering 152. 3 units. *Board or Dollas*

254. Fault-Tolerant and Testable Computer Systems. Faults and failure mechanisms, test generation techniques and diagnostic program development for detection and location of faults in digital networks; design for testability, redundancy techniques, self-checking and fail-safe networks, fault-tolerant computer architectures. Prerequisite: Electrical Engineering 151 or equivalent. C-L: Computer Science 207. 3 units. *Marinos*

255. Mathematical Methods for Systems Analysis I. Basic concepts and techniques used in the stochastic modeling of systems. Elements of probability, statistics, queuing theory, and simulation. Prerequisite: four semesters of college mathematics. C-L: Computer Science 226. 3 units. *Trivedi*

257. Performance and Reliability of Computer Networks. Methods for performance and reliability analysis of local area networks as well as wide area networks. Probabilistic analysis using Markov models, stochastic Petri nets, queuing networks, and hierarchical models. Statistical analysis of measured data and optimization of network structures. Prerequisites: Electrical Engineering 156 and 255. 3 units. *Trivedi*

261. Introduction to VLSI Design. A first course in VLSI design with CMOS technologies. A study of devices, circuits, fabrication technology, logic design techniques, subsystem design and system architecture. Modeling of circuits and subsystems. Testing of gates, subsystems and chips, and design for testability. The fundamentals of full-custom design, and some semi-custom design. Prerequisite: Electrical Engineering 151 or equivalent; Electrical Engineering 161 or equivalent. 3 units. *Dollas or Overhauser*

262. Advanced VLSI Design and Test. An advanced course in VLSI design with emphasis on the design of application specific IC's (ASIC) for a given set of specifications. Discussions of available technologies for ASIC implementation and tradeoffs in using these technologies. Static and dynamic CMOS design of commonly used circuits (adders, multipliers, RAM, pads). Packaging and testing of ASIC's with emphasis on functional and performance verification. This course stresses the design of ASIC's within a systems design environment and with the use of appropriate design tools that can be used to validate a design based on a given set of design specifications. Prerequisite: Electrical Engineering 261. 3 units. *Dollas or Kanopoulos*

266. Introduction to VLSI Design Verification Techniques. VLSI verification tool design. Design and capabilities of circuit simulation, timing simulation, logic simulation, and functional simulation. Techniques applied in timing verification and other static verification tools. Parallel processing and its application to simulation. Physical design issues related to verification. Prerequisite: Electrical Engineering 261, working knowledge of C. 3 units. *Overhauser*

269. Introduction to VLSI Chip Testing. Introduction to VLSI chip and system testing. Testing theory, strategies, and fault identification. Hands-on testing experience with faulty chips and systems, chips designed in Electrical Engineering 261, and testing equipment available in the department. Prerequisite: Electrical Engineering 261. 3 units. *Overhauser*

271. Electromagnetic Theory. The classical theory of Maxwell's equations; electrostatics, magnetostatics, boundary value problems including numerical solutions, currents and their interactions, and force and energy relations. Three class sessions. Consent of instructor required. 3 units. *Joines*

272. Electromagnetic Communication Systems. Review of fundamental laws of Maxwell, Gauss, Ampere, and Faraday. Elements of waveguide propagation and antenna radiation. Analysis of antenna arrays by images. Determination of gain, loss, and noise temperature parameters for terrestrial and satellite electromagnetic communication systems. Prerequisite: Electrical Engineering 170 or 271. 3 units. *Joines*

273. Optical Communication Systems. Mathematical methods, physical ideas, and device concepts of optoelectronics. Maxwell's equations, and definitions of energy density and power flow. Transmission and reflection of plane waves at interfaces. Optical resonators, waveguides, fibers, and detectors are also presented. Prerequisite: Electrical Engineering 170 or equivalent. 3 units. *Joines*

274. Modern Optics. Optical processes including the propagation of light, coherence, interference, and diffraction. Consideration of the optical properties of solids with applications of these concepts to lasers and modern optical devices. C-L: Physics 185. 3 units. *Guenther*

275. Microwave Electronic Circuits. Microwave circuit analysis and design techniques. Properties of planar transmission lines for integrated circuits. Matrix and computer-aided methods for analysis and design of circuit components. Analysis and design of input, output, and interstage networks for microwave transistor amplifiers and oscillators. Topics on stability, noise, and signal distortion. Prerequisite: Electrical Engineering 170 or equivalent. 3 units. *Joines*

281. Random Signals and Noise. Introduction to mathematical methods of describing and analyzing random signals and noise. Review of basic probability theory; joint, conditional, and marginal distributions; random processes. Time and ensemble averages, correlation, and power spectra. Optimum linear smoothing and predicting filters. Introduction to optimum signal detection and parameter estimation. Prerequisite: Mathematics 135 or Statistics 113. 3 units. *Hansen*

282. Digital Signal Processing. Introduction to the fundamentals of processing signals by digital techniques with applications to practical problems. Discrete time signals and systems, elements of the Z-transform, discrete Fourier transforms, digital filter design techniques, fast Fourier transforms, and discrete random signals. 3 units. *Nolte*

283. Digital Communication Systems. Digital modulation techniques. Coding theory. Transmission over bandwidth constrained channels. Signal fading and multipath effects. Spread spectrum. Optical transmission techniques. Prerequisite: Electrical Engineering 281 or consent of instructor. 3 units. *Bottomley*

285. Signal Detection and Extraction Theory. Introduction to signal detection and information extraction theory from a statistical decision theory viewpoint. Subject areas covered within the context of a digital environment are decision theory, detection and estimation of known and random signals in noise, estimation of parameters and adaptive recursive digital filtering, and decision processes with finite memory. Applications to problems in communication theory. Prerequisite: Electrical Engineering 281 or consent of instructor. 3 units. *Nolte*

286. Digital Processing of Speech Signals. Detailed treatment of the theory and application of digital speech processing. Modeling of the speech production system and speech signals; speech processing methods; digital techniques applied in speech transmission, speech synthesis, speech recognition, and speaker verification. Acoustic-phonetics, digital speech modeling techniques, LPC analysis methods, speech coding techniques. Application case studies: synthesis, vocoders, DTW (dynamic time warping)/HMM (hidden Markov modeling) recognition methods, speaker verifica-

tion/identification. Prerequisite: Electrical Engineering 182 or equivalent or consent of instructor. 3 units. *Hansen*

287. Underwater Communications. Elements of communication theory and digital signal processing are combined with basic physics and oceanography to offer an overview of underwater communications, with an emphasis on the radar/sonar problem. Beamforming with transducer arrays. Signal design and target resolution; the ambiguity function. The ocean as a communication channel: sound propagation and ambient noise characteristics. Performance analysis of selected communication scenarios and case studies of operational sonar systems. Prerequisite: Electrical Engineering 181 or consent of instructor. 3 units. *Alexandrou*

288. Image and Array Signal Processing. Multidimensional digital signal processing with applications to practical problems in image and sensor array processing. Two-dimensional discrete signals and systems, discrete random fields, 2-D sampling theory, 2-D transforms, image enhancement, image filtering and restoration, space-time signals, beamforming, and inverse problems. Prerequisite: Electrical Engineering 282 or consent of instructor. 3 units. *Krolik*

299. Advanced Topics in Electrical Engineering. Opportunity for study of advanced subjects related to programs within the electrical engineering department tailored to fit the requirements of a small group. Consent of Director of Undergraduate Studies and of supervising instructor required. Variable credit. *Staff*

312. Electronic Properties of Submicron Solid-State Devices. Review of quantum mechanics, scattering and transport, Boltzmann transport equation, quantum effects in devices with emphasis on one- and two-dimensional transport, electron-polar phonon interactions, quantum transport. Prerequisite: quantum mechanics. C-L: Physics 333. 3 units. *Strosio*

316. Advanced Physics of Semiconductor Devices. Semiconductor materials: band structure and carrier statistics. Advanced treatments of metal-semiconductor contacts, Schottky barriers, p-n junctions, bipolar transistors (charge-control and Gummel-Poon models), and field-effect transistors (short channel effects, scaling theory, subthreshold conduction, nonuniformly doped substrates, surface and buried-channel devices, hot-electron effects). Device modeling in two dimensions using PISCES. Prerequisite: Electrical Engineering 216. 3 units. *Goodwin-Johansson and Massoud*

318. Integrated Circuit Fabrication Laboratory. Introduction to IC fabrication processes. Device layout. Mask design and technology. Wafer cleaning, etching, thermal oxidation, thermal diffusion, lithography, and metallization. Laboratory fabrication and characterization of basic IC elements (p-n junctions, resistors, MOS capacitors, gated diodes, and MOSFETs). Use of four-point probe, ellipsometer, spreading resistance probe, scanning electron microscope, and evaporation system. Testing of basic inverters and gates. Prerequisites: Electrical Engineering 218 and consent of instructor. 3 units. *Massoud*

352. Advanced Topics in Digital Systems. A selection of advanced topics from the areas of digital computer architectures and fault-tolerant computer design. Prerequisite: Electrical Engineering 252 or equivalent. C-L: Computer Science 308. 3 units. *Staff*

361. Advanced VLSI Design. Theory of advanced VLSI design. Specifications development, methodology, issues, circuit-level trade-offs. Full custom design, standard cell design, gate array design, silicon compilation. Semiconductor technologies and logic families for semi-custom design. Clocking schemes and distribution, race conditions. Design of a variety of circuits (adders, I/O drivers, RAM, FIFO, etc.) Testing of all phases in the life cycle of an integrated circuit. Top-down design and bottom-up implementa-

tion. Student projects. Prerequisite: Electrical Engineering 261 or equivalent. C-L: Computer Science 310. 3 units. *Dollas or Kedem*

399. Special Readings in Electrical Engineering. Special individual readings in a specified area of study in electrical engineering. Approval of director of graduate studies required. 1 to 4 units. Variable credit. *Graduate staff*

COURSES CURRENTLY UNSCHEDULED

241. Linear Systems

311. Quantum Electronics

334. Nonlinear Oscillations in Physical Systems

342. Optimal Control Theory

371. Advanced Electromagnetic Theory

373. Selected Topics in Field Theory

382. Advanced Topics in Signal Processing

383. Applied Information Theory and Statistical Estimation

Mechanical Engineering and Materials Science

Professor Hochmuth, *Chair* (142A Engineering); Professor Harman, *Director of Graduate Studies* (145 Engineering); Professors Behringer, Bejan, Cocks, Dowell, Garg, Gösele, Pearsall, Shaughnessy, Shepard, and Tan; Associate Professors Bliss, Jones, Knight, Needham, and Wright; Assistant Professors Buzzard, Cherry, Clark, Hall, Lozier, Thompson, and Virgin; Research Associate Professor Tran-Son-Tay; Research Assistant Professors Nagchaudhuri, Peretti, and Ping-Beall; Adjunct Professor Lee; Adjunct Associate Professors Crowson, Jenkins, and Wu; Adjunct Assistant Professor Spano

The department offers programs of study and research leading to the M.S. and Ph.D. degrees in both mechanical engineering and materials science. Within mechanical engineering, the broad areas of concentration include thermal and fluids systems, mechanics and biomechanics, and dynamics and control. Within materials science, the areas of concentration include electronic materials, biomaterials, failure analysis, and the determination of material characteristics. The department emphasizes a highly research-oriented Ph.D. degree program. Current research areas available include: cell, membrane, and surface engineering; biorheology; convection; diffusion and heat transfer in heterogeneous media; aeroelasticity; computational fluid dynamics; chaotic systems; vibrations and acoustics of dynamic systems; sound propagation and absorbing materials; unsteady aerodynamics; thermal design by entropy generation minimization; control systems; robotics; expert systems; bearing design and lubrication; magnetic levitation; mechanical properties of human stones; positron annihilation spectroscopy; diffusion and kinetics in Si, GaAs, and other electronic materials; semiconductor wafer bonding; fluid mechanics in biochemical engineering; and structural and offshore mechanics.

202. Engineering Thermodynamics. Axiomatic formulations of the first and second laws. General thermodynamic relationships and properties of real substances. Energy, availability, and second law analysis of energy conversion processes. Reaction and multiphase equilibrium. Power generation. Low temperature refrigeration and the third law of thermodynamics. Thermodynamic design. 3 units. *Bejan*

205. Biochemical Engineering. Prerequisite: Mathematics 103. See C-L: Biochemical Engineering 205. 3 units. *Cherry*

207. Transport Phenomena in Biological Systems. See C-L: Biochemical Engineering 207; also C-L: Biomedical Engineering 207 and Civil Engineering 207. 3 units. *Truskey*

208. Introduction to Colloid and Surface Science. This course divides naturally into three sections. The colloid state: classification of colloids and the theoretical frameworks and experimental techniques involved in their characterization. Interfaces: surface tension and free energy; curved interfaces; adhesion, cohesion and wetting; surface activity; catalytic and mechanical properties of solid surfaces. Inter-Surface Forces: the balance of attractive and repulsive forces which operate between colloidal particles and at macroscopic surfaces. Some emphasis on natural and artificial biomembranes. Consent of instructor required. 3 units. *Needham*

210. Intermediate Dynamics. Comprehensive treatment of space kinematics, kinetics of particles and rigid bodies, generalized coordinates, and Lagrange's equations. Introduction to nonlinear and random dynamic analysis of flexible, continuous systems and stability. C-L: Civil Engineering 210. 3 units. *Virgin*

211. Theoretical and Applied Polymer Science. An advanced course in materials science and engineering dealing specifically with the structure and properties of polymers. Particular attention paid to recent developments in the processing and use of modern plastics and fibers. Product design considered in terms of polymer structures, processing techniques, and properties. C-L: Biomedical Engineering 208. 3 units. *Clark*

212. Electronic Materials. An advanced course in materials science and engineering dealing with the various materials important for solid-state electronics including semiconductors, ceramics, and polymers. Emphasis on thermodynamic concepts and on defects in these materials. Materials preparation and modification methods for technological applications. Prerequisite: Engineering 83L. 3 units. *Gösele or Tan*

214. Corrosion and Corrosion Control. Environmental aspects of the design and utilization of modern engineering alloys. Theory and mechanisms of corrosion, particularly in seawater and atmospheric environments. Microstructural aspects of diffusion, oxidation, hot corrosion, and stress corrosion. Prerequisite: Engineering 83L. 3 units. *Jones*

215. Biomedical Materials and Artificial Organs. See C-L: Biomedical Engineering 215. 3 units. *Clark*

217. Fracture of Engineering Materials. Conventional design concepts and their relationship to the occurrence of fracture. Linear elastic and general yield fracture mechanics. Microscopic plastic deformation and crack propagation. The relationship between macroscopic and microscopic aspects of fracture. Time dependent fracture. Fracture of specific materials. Prerequisites: Engineering 83L and Mechanical Engineering 115L. 3 units. *Jones*

218. Thermodynamics of Electronic Materials. Basic thermodynamic concepts applied to solid state materials with emphasis on technologically relevant electronic materials such as silicon and GaAs. Thermodynamic functions, phase diagrams, solubilities and thermal equilibrium concentrations of point defects; nonequilibrium processes and the kinetic phenomena of diffusion, precipitation, and growth. 3 units. *Tan*

221. Compressible Fluid Flow. Basic concepts of the flow of gases from the subsonic to the hypersonic regime. One-dimensional wave motion, the acoustic equations, and waves of finite amplitude. Effects of area change, friction, heat transfer, and shock on one-dimensional flow. Moving and oblique shock waves and Prandtl-Meyer expansion. 3 units. *Shaughnessy*

225. Mechanics of Viscous Fluids. Equations of motion for a viscous fluid, general properties and selected solutions of the Navier-Stokes equations, the Stokes equations, laminar boundary layer equations with selected solutions and approximation techniques, origin of turbulence. 3 units. *Hochmuth*

226. Intermediate Fluid Mechanics. A survey of the principal concepts and equations of fluid mechanics, fluid statics, surface tension, the Eulerian and Lagrangian description, kinematics, Reynolds transport theorem, the differential and integral equations of motion, constitutive equations for a Newtonian fluid, the Navier-Stokes equations, and boundary conditions on velocity and stress at material interfaces. 3 units. *Shaughnessy*

227. Advanced Fluid Mechanics. Flow of a uniform incompressible viscous fluid. Exact solutions to the Navier-Stokes equation. Similarity methods. Irrotational flow theory and its applications. Elements of boundary layer theory. Prerequisite: Mechanical Engineering 226 or consent of instructor. 3 units. *Shaughnessy*

228. Lubrication. Derivation and application of the basic governing equations for lubrication; the Reynolds equation and energy equation for thin films. Analytical and computational solutions to the governing equations. Analysis and design of hydrostatic and hydrodynamic slider bearings and journal bearings. Introduction to the effects of fluid inertia and compressibility. Dynamic characteristics of a fluid film and effects of bearing design on dynamics of machinery. Prerequisites: Mathematics 111 and Mechanical Engineering 126L. 3 units. *Knight*

229. Computational Fluid Mechanics and Heat Transfer. An exposition of numerical techniques commonly used for the solution of partial differential equations encountered in engineering physics. Finite-difference schemes (which are well-suited for fluid mechanics problems); notions of accuracy, conservation, consistency, stability, and convergence. Recent applications of weighted residuals methods (Galerkin), finite-element methods, and grid generation techniques. Through specific examples, the student is guided to construct and assess the performance of the numerical scheme selected for the particular type of transport equation (parabolic, elliptic, or hyperbolic). 3 units. *Staff*

230. Modern Control and Dynamic Systems. Dynamic modeling of complex linear and nonlinear physical systems involving the storage and transfer of matter and energy. Unified treatment of active and passive mechanical, electrical, and fluid systems. State-space formulation of physical systems. Time and frequency-domain representation. Controllability and observability concepts. System response using analytical and computational techniques. Lyapunov method for system stability. Modification of system characteristics using feedback control and compensation. Emphasis on application of techniques to physical systems. 3 units. *Garg*

235. Advanced Mechanical Vibrations. Analytical and experimental procedures applied to the design of machines and systems for adequate vibration control. Determination of eigenvalues and eigenvectors by iteration and computer techniques, transfer matrices applied to lumped and distributed systems, analytical and numerical methods of obtaining the pulse response of plane and three-dimensional multimass systems, convolution and data processing, introduction to random vibration. 3 units. *Knight or Wright*

236. Engineering Acoustics. Fundamentals of acoustics including sound generation, propagation, reflection, absorption, and scattering. Emphasis on basic principles and analytical methods in the description of wave motion and the characterization of sound fields. Applications including topics from noise control, sound reproduction, architectural acoustics, and aerodynamic noise. Occasional classroom or laboratory

demonstration. Prerequisites: Engineering 123L and Mathematics 111 or consent of instructor. 3 units. *Bliss*

237. Aerodynamics. Fundamentals of aerodynamics applied to wings and bodies in subsonic and supersonic flow. Basic principles of fluid mechanics and analytical methods for aerodynamic analysis. Two- and three-dimensional wing theory, slender-body theory, lifting surface methods, vortex and wave drag. Brief introduction to vehicle design, performance, and dynamics. Special topics such as unsteady aerodynamics, vortex wake behavior, and propeller and rotor aerodynamics. 3 units. *Bliss*

238. Advanced Aerodynamics. Advanced topics in aerodynamics. Conformal transformation techniques. Three-dimensional wing theory, optimal span loading for planar and nonplanar wings. Ground effect and tunnel corrections. Propeller theory. Slender wing theory and slender body theory, transonic and supersonic area rules for minimization of wave drag. Numerical methods in aerodynamics including source panel and vortex lattice methods. Prerequisite: Mechanical Engineering 237. 3 units. *Hall*

239. Unsteady Aerodynamics. Analytical and numerical methods for computing the unsteady aerodynamic behavior of airfoils and wings. Small disturbance approximation to the full potential equation. Unsteady vortex dynamics. Kelvin impulse and apparent mass concepts applied to unsteady flows. Two-dimensional unsteady thin airfoil theory. Time domain and frequency domain analyses of unsteady flows. Three-dimensional unsteady wing theory. Introduction to unsteady aerodynamic behavior of turbomachinery. Prerequisite: Mechanical Engineering 237. 3 units. *Hall*

240. Patent Technology and Law. The use of patents as a technological data base is emphasized including information retrieval in selected engineering disciplines. Fundamentals of patent law and patent office procedures. Consent of instructor required. 3 units. *Cocks*

242. Process Analysis and Design. See C-L: Biochemical Engineering 242. 3 units. *Cherry*

245. Applications in Expert Systems. A comprehensive introduction to the key practical principles, techniques, and tools being used to implement knowledge-based systems. The classic MYCIN system studied in detail to provide historic perspective. Current systems employing combinations of production rules, prototypical knowledge, and frame-based case studies. Student term projects consist of the development of individual, unique expert systems using the Texas Instruments Personal Consultant. Knowledge of LISP not a prerequisite. 3 units. *Wright*

252. Buckling of Engineering Structures. Prerequisite: Civil Engineering 131L or consent of instructor. See C-L: Civil Engineering 252. 3 units. *Biswas or Virgin*

260. Animal Cell Culture Engineering. Prerequisite: Biochemical Engineering/Mechanical Engineering 205. See C-L: Biochemical Engineering 260. 3 units. *Cherry*

265. Advanced Topics in Mechanical Engineering. Opportunity for study of advanced subjects related to programs within mechanical engineering tailored to fit the requirements of a small group. Approval of Director of Undergraduate or Graduate Studies required. Variable credit. *Staff*

268. Cellular and Biosurface Engineering. A combination of fundamental concepts in materials science, colloids, and interfaces that form a basis for characterizing: the physical properties of biopolymers, microparticles, artificial membranes, biological membranes, and cells; and the interactions of these materials at biofluid interfaces. Definition of the subject as a coherent discipline and application of its fundamental

concepts to biology, medicine, and biotechnology. Prerequisite: Mechanical Engineering 208 or consent of instructor. 3 units. *Needham*

270. Robot Control and Automation. Review of kinematics and dynamics of robotic devices; mechanical considerations in design of automated systems and processes, hydraulic and pneumatic control of components and circuits; stability analysis of robots involving nonlinearities; robotic sensors and interfacing; flexible manufacturing; man-machine interaction and safety consideration. Prerequisites: Mechanical Engineering 230 or equivalent and consent of instructor. 3 units. *Garg*

277. Optimization Methods for Mechanical Design. Definition of optimal design. Methodology of constructing quantitative mathematical models. Nonlinear programming methods for finding "best" combination of design variables: minimizing steps, gradient methods, flexible tolerance techniques for unconstrained and constrained problems. Emphasis on computer applications and term projects. Consent of instructor required. 3 units. *Wright*

280. Convective Heat Transfer. Models and equations for fluid motion, the general energy equation, and transport properties. Exact, approximate, and boundary layer solutions for laminar flow heat transfer problems. Use of the principle of similarity and analogy in the solution of turbulent flow heat transfer. Two-phase flow, nucleation, boiling, and condensation heat and mass transfer. 3 units. *Bejan*

281. Conduction and Radiation. Conduction heat transfer in the steady and transient state, in rectangular, cylindrical, and spherical coordinates. Melting and solidification. Radiation exchange involving absorbing and emitting media including gases and flames, combined conduction and radiation, and combined convection and radiation. Exact and approximate methods of solution including separation of variables, transform calculus, numerical procedures, and integral and variational methods. 3 units. *Bejan*

290. Physical Oceanography. Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. Prerequisites: Mathematics 31 and 32 or consent of instructor. C-L: Environment 290 and Geology 203. 3 units. *Lozier*

325. Aeroelasticity. A study of the statics and dynamics of fluid/structural interaction. Topics covered include static aeroelasticity (divergence, control surface reversal), dynamic aeroelasticity (flutter, gust response), unsteady aerodynamics (subsonic, supersonic, and transonic flow), and a review of the recent literature including nonlinear effects such as chaotic oscillations. Prerequisites: Mathematics 230 and consent of instructor. 3 units. *Dowell*

331. Nonlinear Control Systems. Analytical, computational, and graphical techniques for solution of nonlinear systems; Krylov and Bogoliubov asymptotic method; describing function techniques for analysis and design; Liapounov functions and Lure's methods for stability analysis; Aizerman and Kalman conjectures; Popov, circle, and other frequency-domain stability criteria for analysis and synthesis. Prerequisite: Mechanical Engineering 230 or consent of instructor. 3 units. *Garg or Wright*

335. Nonlinear Mechanical Vibration. A comprehensive treatment of the role of nonlinearities in engineering dynamics and vibration. Analytical, numerical, and experimental techniques are developed within a geometrical framework. Prerequisite: Mechanical Engineering 210 or 235 or equivalent. 3 units. *Virgin*

399. Special Readings in Mechanical Engineering. Individual readings in advanced study and research areas of mechanical engineering. Approval of director of graduate studies required. 1 to 3 units. Variable credit. *Staff*

COURSES CURRENTLY UNSCHEDULED

216. Materials Science and Solar Technology

224. An Introduction to Turbulence

322. Mechanics of Viscous Fluids

Biochemical Engineering

Assistant Professor Truskey, *Director of Graduate Studies*; Professors Clark, Hochmuth, Lochmüller, and McIntosh; Associate Professors Henkens, Needham, Quinlan, and Reichert; Assistant Professor Cherry; Research Associate Professor Balber

The biochemical engineering program offers graduate education leading to the M.S. and Ph.D. degrees for those students interested in developing and using engineering principles to understand and implement biological and biochemical processes. Students follow a program of course work to reinforce knowledge of advanced principles of process engineering, transport phenomena, and kinetics, as well as microbiology, immunology, cell biology, chemistry, and biochemistry. Prior undergraduate courses in any or all of these areas would be useful to the applicant. Major emphasis in the program is on experimental research leading to either the M.S. or Ph.D. degrees. A nonthesis M.S. degree option is also available with prior approval.

205. Biochemical Engineering. Mathematical analysis of the effects of substrate concentration, pH, temperature, and chemical inhibitors on the rate and yield of biological processes. Enzyme kinetics. Kinetics of cell growth and metabolite production in batch and continuous culture. Design of bioreactors for microbial, mammalian, and plant cell culture. Prerequisite: Mathematics 103. C-L: Mechanical Engineering 205. 3 units. *Cherry*

207. Transport Phenomena in Biological Systems. An introduction to the modeling of complex biological systems using principles of transport phenomena and biochemical kinetics. Topics include the conservation of mass and momentum using differential and integral balances; rheology of Newtonian and non-Newtonian fluids; steady and transient diffusion in reacting systems; dimensional analysis; homogeneous versus heterogeneous reaction systems. Biomedical and biotechnological applications are discussed. C-L: Biomedical Engineering 207, Civil Engineering 207, and Mechanical Engineering 207. 3 units. *Truskey*

209. Kinetics and Reactor Design. Introduction to chemical and biochemical reaction stoichiometry and kinetics. Concepts of elementary reactions, reaction sequences, steady-state approximations, and rate-limiting steps. Ideal and non-ideal isothermal and non-isothermal reactor design and analysis. Homogeneous and heterogeneous reactor concepts, multiplicity, mass transfer limitations. Prerequisite: Mathematics 111 or consent of instructor. C-L: Biomedical Engineering 209 and Civil Engineering 209. 3 units. *Staff*

216. Transport Phenomena in Cells and Organs. Applications of the principles of mass and momentum transport to the analysis of selected processes of biomedical and biotechnological interest. Emphasis on the development and critical analysis of models of the particular transport process. Topics include: reaction-diffusion processes, transport in natural and artificial membranes, dynamics of blood flow, pharmacokinetics, receptor-mediated processes and macromolecular transport, normal and neoplastic tissue. Prerequisite: Biomedical Engineering 207 or equivalent. C-L: Biomedical Engineering 216. 3 units. *Truskey*

237. Biosensors. Prerequisites: Biomedical Engineering 215 and consent of instructor. See C-L: Biomedical Engineering 237. 3 units. *Reichert*

242. Process Analysis and Design. Combines theory and practical design of continuous processes, with emphasis on chemical and biochemical applications. Design of piping systems, heat exchangers, mixing and agitation. Economic evaluation. Flowsheet synthesis, simulation, and safety reviews. Includes a major design project utilizing these concepts. C-L: Mechanical Engineering 242. 3 units. *Cherry*

244. Applied Microbial Processes. Existing and novel microbial processes as they pertain to biotechnological products, specialty bioconversions, and to treat or exploit wastes. Concepts of microbiology, chemical engineering, the stoichiometry and kinetics of complex microbial metabolism, and process analysis. Specific processes such as carbon oxidation, vinegar and alcohol production, nitrification, methane production, biological electricity generation, recombinant protein secretion, and wastewater treatment in long-term space travel are discussed. Consent of instructor required. C-L: Civil Engineering 244. 3 units. *Staff*

260. Animal Cell Culture Engineering. Biological and engineering requirements for the growth of animal cells in vitro, especially on a large scale. Media requirements, kinetics and stoichiometry of cell growth, oxygen supply techniques, bioreactor designs, instrumentation for cell cultures. Prerequisite: Biochemical Engineering 205. C-L: Mechanical Engineering 260. 3 units. *Cherry*

330. Separation Science. Section .01, fundamental separation chemistry; section .02, practical aspects of chromatographic methods; section .03, larger scale processes. 1 to 3 units. C-L: Chemistry 330. Variable credit. *Lochmüller*

390. Industrial Internship. Students work on practical biochemical engineering problems at an industrial research or manufacturing location. Typically requires full-time commitment for the semester. Consent of instructor required. Variable credit. *Cherry*

399. Special Readings in Biochemical Engineering. Advanced individual study in specific selected areas of biochemical engineering. Consent of instructor and director of graduate studies required. 1 to 3 units. Variable credit. *Staff*

English

Professor Jackson, *Chair* (312 Allen); Professor Tetel, *Director of Graduate Studies* (316 Allen); Professors Applewhite, Butters, Clum, C. Davidson, DeNeef, Fish, Gleckner, F. Lentricchia, A. Patterson, L. Patterson, Price, Randall, Ryals, Sedgwick, B. H. Smith, Strandberg, Tompkins, Torgovnick, and Williams; Professor of the Practice Gopen; Associate Professors Gaines, Gerber, Jones, Mellown, Moon, Pope, Porter, Schwartz, and Willis; Assistant Professors Ferraro, Moses, Pfau, and Tetel; Assistant Professors of the Practice Cox, Hilliard, and M. Lentricchia; Adjunct Professor A. E. Davidson

The department offers graduate work leading to the A.M. and Ph.D. degrees, although normally only students seeking the doctorate are admitted to the department. The A.M. degree, if not already earned elsewhere, may be taken by students en route to the Ph.D. (although it is not required) and by those who elect to leave the doctoral program. A statement of the requirements for the A.M. and Ph.D. degrees may be obtained from the director of graduate studies. The department requires a reading knowledge of at least one foreign language for the Ph.D. degree, the specific language (or languages) to be determined by the student's major areas of academic concentration.

Applicants to the program in English should also furnish a copy (not returnable) of a term paper or other essay in nonfiction prose submitted in fulfillment of a requirement in an academic course.

For Seniors and Graduates

200. English for Academic Purposes. Advanced English composition and speaking for graduate students who are not native speakers of English. Selected readings in nonfiction prose. Weekly conferences in techniques of oral discourse. 3 units. *Brett*

202S. Narrative Writing. The writing of short stories, memoirs, tales, and other narrations. Readings from ancient and modern narrative. Close discussion of frequent submissions by class members. Consent of instructor required. 3 units. *Price*

203S. Advanced Narrative Writing. The writing of extended narrative prose—long stories, novellas, substantive memoirs. Students should be proficient in the writing of short narratives. Consent of instructor required. 3 units. *Price*

205. Semiotics and Linguistics. See C-L: Russian 205. 3 units. *Andrews (Slavic)*

207A. Introduction to Old English. An introduction to the language of the Anglo-Saxon period (700-1100), with readings in representative prose and poetry. Not open to students who have taken 113A or the equivalent. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

207B. Old English Literature. Critical study of Anglo-Saxon prose and poetry, with attention to the historical and cultural context. Not open to students who have taken 113B. Prerequisite: English 113A, 207A or the equivalent. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

208. History of the English Language. Introductory survey of the changes in sounds, forms, and vocabulary of the English language from its beginning to the present, with emphasis on the evolution of the language as a medium of literary expression. Not open to students who have taken English 112. C-L: Medieval and Renaissance Studies. 3 units. *Butters or Tetel*

209. Present-Day English. A survey of contemporary linguistic theories applied to modern English; designed for students of literature and teachers of English. Not open to students who have taken English 115. 3 units. *Butters*

212. Middle English Literature: 1100 to 1500. Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *L. Patterson*

213, 214. Chaucer. 213: first two-thirds of his career, especially *Troilus and Criseyde*. 214: *The Canterbury Tales*. C-L: Medieval and Renaissance Studies. 3 units each. *L. Patterson*

221. Renaissance Prose and Poetry: 1500 to 1660. Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*

222. Reading Milton. Milton's epic as a way of exploring some of the questions that have recently been asked about the humanities in general and literary studies in particular. Is the reconstruction of a perspective within which older texts can be responsibly read possible? What do you have to "know" in order to read *Paradise Lost*? What do you have to know in order to know what you have to know to read *Paradise Lost*? Obviously, *Paradise Lost* will be the center of the course, but we shall also read others of Milton's works and look into the tight little world of Milton criticism. 3 units. *Fish*

225. Renaissance Drama: 1500 to 1642. Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *A. Patterson or Randall*

235. Restoration and Eighteenth-Century Literature: 1660 to 1800. Selected topics. 3 units. *Jackson*

241. Romantic Literature: 1790 to 1830. Selected topics. 3 units. *Applewhite, Gleckner, Jackson, or Pfau*

245. Victorian Literature: 1830 to 1900. Selected topics. 3 units. *Ryals or Sedgwick*

251. British Literature since 1900. Selected topics. 3 units. *F. Lentricchia, Mellow, Moses, or Torgoornick*

263. American Literature to 1865. Selected topics. 3 units. *C. Davidson, Jones, Moon, or Tompkins*

267. American Literature: 1865 to 1915. Selected topics. 3 units. *C. Davidson, Tompkins, or K. Williams*

269. American Women Writers. Selected topics. C-L: Women's Studies. 3 units. *C. Davidson, Pope, or Tompkins*

275. American Literature since 1915. Selected topics. 3 units. *Ferraro, F. Lentricchia, Pope, or Strandberg*

281. Studies in Genre. History, criticism, and theory of literary genres such as the novel, pastoral, epic, and drama. 3 units. *Staff*

284. Contemporary Film Theory. Post-1968 film theory—Brechtian aesthetics, cinema semiotics, psychoanalytic film theory, technology, feminist theory, and Third World cinema. 3 units. *Gaines*

285. Major Texts in the History of Literary Criticism. A survey of major critical writings from Aristotle to the present. 3 units. *Staff*

288. Special Topics. Subjects, areas, or themes that cut across historical eras, several national literatures, or genres. 3 units. *Staff*

289. The Theory of the Novel. Major issues in the history and theory of the novel. 3 units. *Moses or Torgoornick*

290. Methods of Composition Pedagogy. A philosophical and practical exploration of developments in the field of composition studies. Cognition, concept formation, psycholinguistics, interpretation, and the making of meaning. Works by Burke, Richards, Kitzhaber, Berlin, Berthoff, Bizzell, Elbow, Corbett, Macrorie, Williams, Coles, and others. 3 units. *Gopen and Hillard*

For Graduates

310. Studies in Old English Literature. Intensive study of major Old English texts. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

312. Studies in Middle English Literature. C-L: Medieval and Renaissance Studies. 3 units. *L. Patterson*

315. Studies in Chaucer. C-L: Medieval and Renaissance Studies. 3 units. *Fish or L. Patterson*

321. Studies in Renaissance Literature. C-L: Medieval and Renaissance Studies and Women's Studies. 3 units. *DeNeef, Fish, A. Patterson, Porter, Randall, or Schwartz*

324. Studies in Shakespeare. C-L: Medieval and Renaissance Studies. 3 units. *A. Patterson or Porter*

329. Studies in Milton. C-L: Medieval and Renaissance Studies. 3 units. *DeNeef, Fish, A. Patterson, or Schwartz*

337. Studies in Augustanism. 3 units. *Jackson*

- 338. Studies in a Major Augustan Author.** 3 units. *Jackson*
- 341. Studies in Romanticism.** 3 units. *Applewhite, Gleckner, Jackson, or Pfau*
- 347. Studies in Victorianism.** 3 units. *Ryals or Sedgwick*
- 348. Studies in a Major Nineteenth-Century British Author.** 3 units. *Gleckner, Jackson, Pfau, Ryals, or Sedgwick*
- 353. Studies in Modern British Literature.** 3 units. *Mellown, Moses, or Torgovnick*
- 361. Studies in American Literature before 1915.** 3 units. *Jones, Moon, Tompkins, or K. Williams*
- 368. Studies in a Major American Author before 1915.** 3 units. *C. Davidson, Jones, Moon, Tompkins, or K. Williams*
- 375. Studies in Modern American Literature.** 3 units. *Applewhite, Ferraro, Lentricchia, or Strandberg*
- 376. Studies in a Modern Author (British or American).** 3 units. *Applewhite, Lentricchia, Mellown, Moses, Pope, Strandberg, or Torgovnick*
- 381. Special Topics Seminar.** 3 units. *Staff*
- 385. Studies in Literary Criticism.** 3 units. *Fish, Lentricchia, Moses, Pfau, Pope, Sedgwick, B. H. Smith, or Tompkins*
- 386. Problems in the Theory of Value and Judgment.** See C-L: Literature 300; also C-L: Philosophy 300. 3 units. *B. H. Smith*
- 388. The History of Rhetoric: Classical to Renaissance.** The foundations of rhetorical studies from Plato, Aristotle, Cicero, and Quintilian through Longinus, Augustine, and Erasmus to Bacon and Ramus. No prerequisites. 3 units. *Gopen*
- 389. The History of Rhetoric: Eighteenth to Twentieth Centuries.** Continuing study of the major texts in the history of rhetoric with special attention paid to J. Q. Adams, Campbell, Blair, Whately, Bain, Perelman, and Burke. Prerequisite: English 388. 3 units. *Gopen*
- 390. Composition Theory and Pedagogy.** Methodologies of teaching composition, with special emphasis on the theories of structural stylistics employed in the University Writing Program (UWP). All students registering in the course must hold a tutorship in the UWP, must attend the UWP training seminar and all scheduled UWP staff meetings, and will be observed teaching by a UWP director. Ungraded. 3 units. *Gopen*
- 391. Tutorial in Special Topics.** Directed research and writing in areas unrepresented by regular course offerings. Consent of instructor required. 3 units. *Staff*
- 392. Tutorial in Journal Editing.** Systematic exposure to all phases of academic journal editing. Restricted to holders of journal editing internships. Ungraded. Variable credit. *Staff*
- 393. Professionalism, Theory, and Power in Legal and Literary Studies.** 3 units. *Fish*

COURSES CURRENTLY UNSCHEDULED

- 283S. Feminist Theory and the Humanities**
- 383. Studies in Textual Criticism**

TUTORIALS

Tutorials in specialized subjects of study not available in the courses listed above may be offered to single students or to small groups. Instruction normally will be conducted in weekly sessions, or more frequently if the instructor wishes. Emphasis will be on independent reading and investigation, and on oral and written reports. A substantial amount of writing will be required.

Permission of the instructor and the director of graduate studies is required.

Environment

Professor Christensen, *Chair and Director of Graduate Studies* (216 Biological Sciences); Professors Barber, C. Bonaventura, J. Bonaventura, Dutrow, Forward, Gutknecht, Healy, Johnson, Knoerr, Pilkey, Ramus, Richardson, Robertson, Sutherland, Terborgh, and Vesilind; Associate Professors Di Giulio, Kramer, Reckhow, Richter, and Rittschof; Assistant Professors Faust, Gerhart, Howd, Lozier, Maguire, Oren, Parks, and Van Beneden; Professors Emeriti Anderson, Hellmers, Jayne, Kramer, Osborne, Philpott, Stambaugh, and Yoho; Adjunct Professors Boyce, Dieter, Sizemore, and Steen

Major and minor work is offered in the areas of natural resource and environmental science/ecology, systems science, and economics/policy. Programs of study and research lead to the A.M., M.S., and Ph.D. degrees. College graduates who have a bachelor's degree in one of the natural or social sciences, forestry, engineering, business, or environmental science will be considered for admission to a degree program. Students will be restricted to the particular fields of specialization for which they are qualified academically. Graduate School programs usually concentrate on some area of natural resource and environmental science/ecology, systems science, or economics/policy, while study in resource and environmental management is more commonly followed in one of the professional master's degree programs of the School of the Environment. For more complete program descriptions and information on professional training in forestry or environmental studies, the *Bulletin of Duke University: School of the Environment* should be consulted.

The specific degrees available in natural resources and the environment through the Graduate School are: the A.M. (with or without a thesis), M.S. (with a thesis), and the Ph.D. Students may be required to demonstrate satisfactory knowledge of one or two foreign languages for the Ph.D. degree. More information on degree and language requirements can be found in the registration and regulations section of this bulletin.

200. Integrated Case Studies. A group of two to four students may plan and conduct integrated research projects on a special topic, not normally covered by courses or seminars. A request to establish such a project should be addressed to the case studies director with an outline of the objectives and methods of study and a plan for presentation of the results to the school. Each participant's adviser will designate the units to be earned (up to 6 units) and evaluate and grade the work. Variable credit. *Staff*

201. Forest Resources Field Skills. Introduction to field techniques commonly used to quantify and sample forest resources: trees, soils, water, and animal resources. Dendrology, vegetation sampling, soil mapping, river flow estimation, field water quality sampling, surveying, and use of compass. 2 units. *Davison and Richter*

204. Forest Inventory, Growth, and Yield. Measurement of land and forests for purposes of management, appraisal, purchase, and sale. Techniques for predicting the growth and future yield of stands by various methods. 3 units. *Davison*

205. Ecological Management of Forest Systems (Silviculture). The aim of the course is to equip future resource managers and environmental consultants with knowledge allowing them to propose lower impact practices to individuals and organizations

edge allowing them to propose lower impact practices to individuals and organizations who need to balance wood production with maintenance of environmental quality. Underlying principles of growth, from seed to mature trees, and stand dynamics are explored. Various alternative methods of manipulating growth, stand structure and development, ranging from little to large perturbations of forest systems, are presented and assessed in terms of their effect on resource quality. 3 units. *Oren*

205L. Ecological Management of Forest Systems (Silviculture). Same as 205 with laboratory. 4 units. *Oren*

207. Forest Pest Management. Fundamentals of entomology and plant pathology as appropriate to understanding the impacts of insects and diseases on forest productivity and their assessment for integration into forest management. Regional case examples and complexes are evaluated in terms of pest-population, forest-stand dynamics; economic and societal constraints; treatment strategies; monitoring systems; and benefit-cost analysis. This approach seeks to develop predictive capabilities in long-range pest management and decision making. 3 units. *Stambaugh*

207L. Forest Pest Management. Same as 207 with laboratory which is largely field oriented to focus on diagnostics and impact analysis. 4 units. *Stambaugh*

210. Forest Pathology. Diseases of North American forests and their timbers, with emphasis on current literature and management strategies. Offered on demand. 3 units. *Stambaugh*

210L. Forest Pathology. Same as 210 with laboratory. Field and laboratory diagnosis. Offered on demand. 4 units. *Stambaugh*

211L. Applied Ecology and Ecosystem Management. An application of ecological principles to applied resource and environmental problems with an emphasis on the ecosystem as a basic working unit. Perspectives include such topics as land/water interactions, the patchiness concept, succession, energy flow, productivity, mineral cycling, perturbation effects on ecosystems, and limiting factors. Laboratory studies will focus on the team approach to analyzing the biotic and abiotic components of the ecosystem and impact analysis. 4 units. *Richardson*

212. Environmental Toxicology. Study of environmental contaminants from a broad perspective encompassing biochemical, ecological, and toxicological principles and methodologies. Discussion of sources, environmental transport and transformation phenomena, accumulation in biota and ecosystems. Impacts at various levels of organization, particularly biochemical and physiological effects. Prerequisites: organic chemistry and vertebrate physiology or consent of instructor. 3 units. *Di Giulio*

213. Forest Ecosystems. Emphasis on the processes by which forests circulate, transform, and accumulate energy and materials through interactions of biologic organisms and the forest environment. Ecosystem productivity and cycling of carbon, water, and nutrients provide the basis for lecture and laboratory. 3 units. *Richter*

215. Environmental Physiology. Examination of the concepts of tolerance, limiting factors, bioenergetics, nutrition, stress physiology, homeostasis, and alleopathy for both plant and animal life. Discussion of procedures for and examples of monitoring physiological perturbations due to resource manipulation. 3 units. *Di Giulio and Oren*

216. Applied Population Ecology. Population dynamics of managed and unmanaged populations. A quantitative approach to exploitation and conservation of animal and plant populations, including harvesting, population viability analysis, population genetics. Prerequisites: introductory statistics, calculus, and computer programming or consent of instructor. 3 units. *Maguire*

217. Tropical Ecology. Ecosystem, community, and population ecology of tropical plants and animals with application to conservation and sustainable development. Prerequisite: a course in general ecology. C-L: Botany 215 and Zoology 215. 3 units. *Terborgh*

218L. Barrier Island Ecology. An integration of barrier island plant and animal ecology within the context of geomorphological change and human disturbance. Topics include: barrier island formation and migration, plant and animal adaptations, species interactions, dune succession, maritime forests, salt marshes, sea level rise, conservation policy, and restoration ecology. Field trips to many of the major North Carolina barrier islands. Strong emphasis on field observation and independent research. (Given at Beaufort.) Prerequisite: introductory biology; suggested: course in botany or ecology. C-L: Botany 218L and Marine Sciences. 6 units. *Evans, Peterson, and Wells (visiting summer faculty)*

219L. Marine Ecology. Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent research projects. Topics include characteristics of marine habitats, adaptation to environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. (Given at Beaufort.) Prerequisite: none; suggested—introductory ecology, invertebrate zoology, or marine botany. C-L: Marine Sciences and Zoology 203L. 6 units. *Gerhart*

220. Vegetation Management in Urban Ecosystems. Biology and management of woody vegetation, especially trees, across the urban-forest continuum. Special uses and problems of the urban forest are discussed in terms of socioeconomic, legal, arboricultural, and environmental considerations. Management case studies and field trips will be used to gain insights into tree valuation, inventory, and municipal ordinances and administration. 3 units. *Stambaugh*

221. Soil Resources. Emphasis on soil resources as central components of terrestrial ecosystems, as rooting environments for plants, and as porous media for water. Soil physics and chemistry provide the basis for the special problems examined through the course. Laboratory emphasizes field and lab skills, interpretive and analytical. 3 units. *Richter*

222S. Coastal Processes. Waves and currents in the nearshore zone and their role in beach evolution. Linear wave theory and models for beach evolution. Other topics include nearshore currents, tides, estuarine circulation, and field techniques for measurement of nearshore morphology and fluid motions. Term project required. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Geology 201S and Marine Sciences. 2 units. *Howd*

225L. Coastal Ecotoxicology and Pollution. Principles of transport, fates, food-web dynamics and biological effects of pollutants in the marine environment. Laboratory to stress standard techniques for assessing pollutant levels and effects. (Given at Beaufort.) Prerequisites: introductory chemistry and biology. C-L: Marine Sciences. 4 units. *Staff*

226. Cetacean Biology. Taxonomy, life cycles, social organization, behavior, communication, and conservation of whales and dolphins. Social organization and acoustic communication in the local bottlenose dolphin population. (Given at Beaufort.) Prerequisite: introductory biology suggested. C-L: Marine Sciences. 2 units. *Forward and staff*

230L. Weather and Climate. Overview of the science of meteorology and principles of climatology, especially as applied to problems in ecology and natural resource management. Emphasis on the processes and characteristics of weather phenomena and

local and regional climates. General introduction to sources of climatic data and climatic data analysis. Includes laboratory. 4 units. *Knoerr*

232. Microclimatology. Introduction to the micrometeorological processes. Discussion of the integration of these processes and the resulting microclimates in the rural (forest, field, and water surface) and urban environments. Methods for modification of the microclimate. Offered on demand. C-L: Botany 232. 3 units. *Knoerr*

234L. Watershed Hydrology. Introduction to the hydrologic cycle with emphasis on the influence of land use, vegetation, soil types, climate, and land forms on water quantity and quality and methods for control. Development of water balance models. Analysis of precipitation patterns, rainfall and runoff, and nonpoint source impacts. Statistical handling and preparation of hydrologic data, simulation and prediction models, introduction to groundwater flow, laboratory and field sampling methods. 4 units. *Staff*

235. Air Quality Management. Types, sources, effects of air pollutants. Regulatory framework emphasizing the Clean Air Act Amendments of 1990 and federal, state, local agency implementation. Application of risk assessment, technology, market incentives to air management. Scientific, policy aspects of acid deposition, global climate change, indoor air, mobile sources control. Dispersion modeling, exposure assessment. 3 units. *Vandenberg*

236. Water Quality Management. Types, sources, and effects of pollutants. Water quality standards and criteria. Engineering approaches to water management. Mathematical models and their application to water quality management. Federal regulations, in particular, the Federal Water Pollution Control Act and the Safe Drinking Water Act. Policy analysis for water quality management planning. 3 units. *Reckhow*

238. Hydrologic Transport Processes. Physical and chemical processes governing the transport and fate of contaminants in the terrestrial portion of the hydrologic cycle. An integrated, interdisciplinary approach to quantitative aspects of contaminant transport with emphasis placed on surface water and shallow soil processes. Advection, dispersion, and mixing in streams, lakes, and estuaries; chemical and biological reactions in surface waters and soils; transport through porous media. Case studies involving numerical models of contaminant transport will be used. Prerequisites: Environment 234, 242, or equivalent and familiarity with calculus. 3 units. *Staff*

240. Fate of Organic Chemicals in the Environment. Kinetic, equilibrium, and analytical approaches applied to quantitative description of processes affecting the fate of anthropogenic and natural organic compounds in ground, surface, and atmospheric waters and in selected treatment processes, including sorption phenomena, gas transfer, hydrolysis, photochemistry, oxidation-reduction, and biodegradation. Sampling, detection, identification, and quantification of organic compounds in the environment. Gas and liquid chromatology and mass spectrometry. Prerequisite: (or corequisite) Civil Engineering 242/Environment 242 or equivalent. C-L: Civil Engineering 240. 3 units. *Dubay and Faust*

242. Environmental Chemistry. Principles of chemical kinetics and equilibria applied to quantitative description of the chemistry of lakes, rivers, oceans, atmospheric waters, groundwaters, and selected treatment processes. Equilibrium, steady state, and other kinetic models applied to processes such as the carbonate system, coordination chemistry, precipitation and dissolution, oxidation-reduction, photochemistry, heterogeneous reactions, gas transfer, and some aspects of atmospheric chemistry. C-L: Civil Engineering 242. 3 units. *Faust*

243. Environmental Biochemistry. Introduction to the (macro)molecules of life and fundamental metabolic pathways. Topics are presented in the context of environmental

perturbations. Fundamental aspects of energetics, proteins, enzymes, carbohydrates, lipids, and nucleic acids. Emphasis on mechanisms of adaptation, molecular controls, and responses to toxicants. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Cell Biology 243 and Marine Sciences. 3 units. *Bonaventura and Brouwer*

244. Cellular and Molecular Research Techniques. Introduction to the use of electrophoresis, chromatography, enzymology, equilibrium assays, rapid reaction kinetics, microscopy, molecular graphics, and various modes of spectroscopy in analyzing molecules and tissues of organisms collected from polluted and pristine environments. The applicability of techniques of modern molecular biology are discussed in relation to other research techniques used to examine fundamental molecular mechanisms and the adverse effects of pollutants on natural processes. (Given at Beaufort.) Prerequisite: organic chemistry. C-L: Cell Biology 244 and Marine Sciences. 3 units. *Bonaventura and Brouwer*

251. Statistics and Data Analysis in Biological Science. Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. Emphasis on biological science applications. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210A, or 213. C-L: Statistics 210B. 3 units. *Staff*

252L. Techniques in Environmental Data Analysis. Introduction to techniques commonly used by environmental scientists for the study of spatial and cross-spectral analysis and empirical orthogonal functions. Emphasis on developing a hands-on understanding of the methods and correct interpretation of results. Lectures and laboratory. Term project required. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Geology 222L and Marine Sciences. 4 units. *Howd*

253. Biometry. A practically oriented overview of the statistical analysis of biological data. Topics include data collection and experimental design, methods and techniques of data organization, use of computing programs and packages, applications of appropriate parametric and nonparametric statistical techniques, assumptions and problems encountered with biological data analysis, and interpretation of results. Prerequisite: Mathematics 136, Psychology 117, Sociology 133, Statistics 10D, 110, 112, 114, 213, or equivalent. C-L: Biological Anthropology and Anatomy 250. 3 units. *Gerhart and White*

261. Remote Sensing for Resource Management. An examination of remote sensing systems as sources of information in resource management with an emphasis on aerial photography and multispectral scanners. Emphasis on the interpretation of airborne and space imagery. 3 units. *Davison*

262. Forest Utilization Field Trip. Introduction to utilization in the managed forest and the principal wood-using industries. Taught as a one-week field seminar. May be taken by nonforestry majors. 1 unit. *Staff*

266. Ecology of Southern Appalachian Forests. Field trips to various forest ecosystems in the southern Appalachian Mountains. Species identification, major forest types, field sampling, and history of effects of human activities. Consent of instructor required. 1 unit. *Richter*

270L. Resource and Environmental Economics. The application of economic concepts to private- and public-sector decision making concerning natural and environmental resources. Intertemporal resource allocation, benefit-cost analysis, valuation of environmental goods and policy concepts. Includes laboratory. Prerequisite: introductory course in microeconomics. C-L: Economics 270L and Public Policy Studies 272L. 4 units. *Kramer*

271. Economic Analysis of Resource and Environmental Policies. Case and applications oriented course examining current environmental and resource policy issues. Benefits and costs of policies related to sustaining resource productivity and maintaining environmental quality will be analyzed using economic and econometric methods. Topics include benefit-cost analysis, intergenerational equity, externalities, public goods, and property rights. Prerequisite: Environment 270L or equivalent; Economics 149 recommended. C-L: Economics 272. 3 units. *Parks*

272. Evaluation of Public Expenditures. Basic development of cost benefit analysis from alternative points of view, for example, equity debt, and economy as a whole. Techniques include: construction of cash flows, alternative investment rules, inflation adjustments, optimal timing and duration of projects, private and social pricing. Adjustments for economic distortions, foreign exchange adjustments, risk and income distribution examined in the context of present value rules. Examples and cases from both developed and developing countries. C-L: Economics 261 and Public Policy Studies 261. 3 units. *Conrad*

274. Resource and Environmental Policy. Development of a policy analysis framework for studying resource and environmental policy. Political institutions, interest group theory, public choice theory, role of economics in policy analysis, ethics and values. Application to current and historical U.S. policy issues. Prerequisite: Environment 270L, Public Policy Studies 272, or consent of instructor. C-L: Public Policy Studies 274. 3 units. *Healy and Morton*

276S. Selected Public Policies Topics. 3 units. *Staff*

277. Conservation and Sustainable Development I: Concepts and Methods. Agronomic, ecological, and economic concepts of sustainability, with emphasis on application in developing countries; forest, soil, and wildlife resources; models in conservation biology; historical, cultural, and sociological perspectives; policy analysis. 3 units. *Staff*

278. Conservation and Sustainable Development II: Integrated Problem Solving. Approaches to reconciling conservation and development, with emphasis on developing countries. Case studies; project formulation, implementation, and evaluation; institutional policy formation; conflict resolution. 3 units. *Staff*

282S. Environmental Ethics. Selected topics involving values and the environment, for example, extending morality to nature, rights of future generations, environmental aesthetics, diversity and stability, ideological biases in ecological knowledge. Consent of instructor required. C-L: Philosophy 289S. 3 units. *Cooper*

285. Land Use Principles and Policy. Consideration of four major roles of land in the United States: as a producer of commodities, financial asset, component of environmental systems, and location of development. Analysis of market allocation of land, market failure, role of public planning and regulation. C-L: Public Policy Studies 285. 3 units. *Healy*

290. Physical Oceanography. Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. Prerequisites: Mathematics 31 and 32 or consent of instructor. C-L: Geology 203 and Mechanical Engineering 290. 3 units. *Lozier*

291S. Geological Oceanography. The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 206S. (Given at Beaufort.) C-L: Geology 205S and Marine Sciences. 3 units. *Johnson*

292L. Biological Oceanography. Physical, chemical, and biological processes of the oceans, emphasizing special adaptations for life in the sea and factors controlling distribution and abundance of organisms. Laboratory emphasis. Three units (spring); 6 units (summer). (Given at Beaufort.) Prerequisites: Biology 21L and 22L. C-L: Marine Sciences. Variable credit. *Ramus or staff*

293. Analysis of Ocean Ecosystems. The history, utility, and heuristic value of the ecosystem; ocean systems in the context of Odum's ecosystem concept; structure and function of the earth's major ecosystems. (Given at Beaufort.) Prerequisite: one year of biology, one year of chemistry, or consent of instructor. C-L: Marine Sciences and Zoology 223. 3 units. *Barber*

294L. Marine Communities. Dynamics of marine communities in the context of current ecological theory. Life history strategies, competition, predation, diversity, and stability; detailed considerations of benthic and pelagic communities. (Given at Beaufort.) Prerequisites: Biology 21L and 22L; and Mathematics 31. C-L: Marine Sciences. 4 units. *Gerhart*

295L. Marine Invertebrate Zoology. Structure, functions, and development of invertebrates collected from estuarine and marine habitats. Not open to students who have taken Biology or Zoology 274L. Three units (fall); 6 units (summer). (Given at Beaufort.) Prerequisites: Biology 21L and 22L, or equivalents. C-L: Marine Sciences. Variable credit. *Kirby-Smith*

296L. Benthic Marine Algae. Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and fieldwork in ocean and estuaries. (Given at Beaufort.) Prerequisite: introductory biology; plant diversity recommended. C-L: Botany 219L and Marine Sciences. 4 units. *Schneider (visiting summer faculty)*

297L. Biology of Marine Invertebrates. Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips. Not open to students who have taken Biology 176L. (Given at Beaufort.) Prerequisites: Biology 21L and 22L or equivalents. C-L: Marine Sciences and Zoology 274L. 6 units. *Staff*

299. Independent Studies and Projects. Directed readings or research at the graduate level to meet the needs of individual students. Consent of instructor required. Units to be arranged. Variable credit. *Staff*

302. Models in Forest and Environmental Management. Students learn how to design and choose models for forestry and ecology. Emphasis on using models to develop strategy and evaluate options for culturing forests and related ecosystems. Subjects include timber, wildlife, water, recreation, and cash flow. 3 units. *Boyce*

305. Harvesting Effects on Productivity. Impacts of harvesting on the residual stand, soil properties, water quality, and future site productivity. The integration of harvesting into overall stand management through a full rotation is stressed. Offered on demand. 2 units. *Davison*

306. Dynamic Modeling of Forestry and Natural Resource Management Strategies. Simulation of the financial aspects of silvicultural practices when used to produce timber, wildlife habitat, water, range, and recreational benefits; economics of production; and trade-offs for multiple benefits. Students use actual forest inventories to devise silvicultural strategies, which are simulated with the system dynamics models DYNAST and STELLA on microcomputers. Intensive. Offered on demand. 1 unit. *Boyce*

307. Ecophysiology of Productivity and Stress. Exploration of principles governing stand growth and its response to a variety of stresses. Emphasis on climate, soil resources, and competition. Stresses and their reliefs determined by pollution and the

availability of resources as modifiers of the physiological properties of trees. 3 units. *Oren*

312. Wetlands Ecology and Management. The study of bogs, fens, marshes, and swamps. Emphasis on processes within the ecosystem: biogeochemical cycling, decomposition, hydrology, and primary productivity. Ecosystem structure, the response of these systems to perturbations, and management strategies are discussed. A research project is required. Prerequisites: Environment 211 or equivalent and consent of instructor. 3 units. *Richardson*

313. Advanced Topics in Environmental Toxicology. Discussion of current issues. Topics vary but may include chemical carcinogenesis in aquatic animals; biomarkers for exposure and sublethal stress in plants and animals; techniques for ecological hazard assessments; and means of determining population, community, and ecosystem level effects. Lectures and discussions led by instructor, guest speakers, and students. Prerequisite: Environment 212. 3 units. *Di Giulio*

314. Integrated Case Studies in Toxicology. Students are assigned topics relative to their chosen research discipline in toxicology and are asked to develop case studies to present at a roundtable workshop. Emphasis on review and analysis of toxicological problems from a holistic (multidisciplinary) viewpoint. Offered on demand. C-L: Pharmacology 314. 1 unit. *Abou-Donia and Richardson*

316. Case Studies in Environmental and Forest Management. Structured methods for environmental and resource problem solving, including benefit-cost, statistical, and decision analyses, as well as simulation and optimization, are applied to case studies. Previous course work provides a foundation for addressing ecological, economic, ethical, and sociopolitical aspects of management issues. Students work in teams to develop operational management plans which are presented in oral and written form. Prerequisite: Environment 211, 270, 350, familiarity with a computer programming language, or consent of instructors. 4 units. *Maguire and Parks*

317. Topics in Tropical Ecology and Conservation. Discussion of current issues and ideas at the interface between basic and applied science. Lectures, seminars, and discussion with student participation. Prerequisite: Environment 217 or equivalent. 2 units. *Terborgh*

319. Environmental Toxicology and Risk Assessment. Examination of processes that control the transport, fate, and effects of key groups of environmental contaminants. Methods of risk assessment, including modeling, uncertainty analysis, and decision theory. Intensive. 1 unit. *Di Giulio, Faust, and Reckhow*

322L. Microbiology of Forest Soils. Ecology of the microbial populations of forest soils, with emphasis on rhizosphere interactions, root pathogenesis, and mycorrhizae. Includes laboratory. Offered on demand. Prerequisites: consent of instructor; mycology and bacteriology are recommended. 4 units. *Stambaugh*

330L. Environmental Monitoring and Instrumentation. Methods of measuring and monitoring the earth's physical environment with emphasis on water and air resources. Characteristics and uses of contemporary sensors, measurement and data acquisition systems. Methods of obtaining and processing computer compatible data records. Includes laboratory. Offered on demand. C-L: Botany 330L. 4 units. *Knoerr*

333. Basic Groundwater Hydrology. Basic principles, concepts, and methods of groundwater hydrology. Topics include water storage and transmission characteristics of rocks, physical features of U.S. groundwater regions, problems related to development and protection of the groundwater resource. Intensive. 1 unit. *R. Heath*

335. Water Quality Modeling. Development and evaluation of simulation models of surface water quality. Mechanistic descriptions of aquatic ecosystems and materials transport. Statistical methods for monitoring design and trend detection. Uncertainty analysis. Prerequisites: Environment 236 and 350. 2 units. *Reckhow*

340. Biohazard Science. Philosophy of safety; etiology, infectivity, and transmissibility of disease; immunity and resistance; occupational and nosocomial infections; aerobiology; biotechnology; disinfection and sterilization; biocontainment and facility design; and safety management. Prerequisite: general microbiology or consent of instructor. 3 units. *Tulis*

341L. Methods in Biohazard Science. Fundamentals of disinfection, sterilization, and biocidal materials methodology, inactivation kinetics and dosimetry; medical waste management; mutagenicity, pyrogenicity, and PCR testing; laminar flow cabinet certification; microbiologic surface and air sampling; respirator assessment; laboratory audits and regulatory compliance. Prerequisite: Environment 340 or consent of instructor. 4 units. *Staff*

342. Bioaerosols. Principles of aerobiology; sick-building syndrome and building-related illness; ventilation, filtration, and humidification systems; chemical and biological pollutants; health effects; sampling and assessment of bioaerosols; remediation measures; handling indoor air quality perceptions. Consent of instructor required. 2 units. *Thomann and Tulis*

343. Hazard Management, Law, and Ethics. Economics and ecology; survey of federal and state laws; legal basis for regulation; enforcement, including inspections and audits, permits and licensing, and citations, injunctions, and penalties; management accountability; ethics in science and medicine; risk assessment and management; policy development and implementation. Consent of instructor required. 3 units. *Warren*

350. Applied Regression Analysis. Regression analysis with nonexperimental data using ordinary least squares. Emphasis on assumption violations: consequences and correctives. Analysis of variance and time series analysis using Box-Jenkins methods as time permits. Applications to problems in natural resource management. Prerequisite: Environment 251 or equivalent. 4 units. *Reckhow*

351. Computer-Based Map Analysis with Geographic Information Systems. Introduction to computer-based map analysis systems (geographic information systems). Use of map algebra in computer analyses of spatially distributed map information. Applications in analyzing and solving natural resource management problems. 3 units. *Knoerr*

355. Optimization Methods for Resource Management. Introductory survey of optimization techniques useful in resource management and environmental decision making. Numerical techniques for unconstrained optimization, linear programming, dynamic programming, and optimal control methods. Consent of instructor required. 3 units. *Staff*

366. Mathematical Modeling of Lake and Reservoir Water Quality. Practical application of mathematical models of lake and reservoir water quality. The major objective is to expose the participant to a wide variety of techniques that are useful in predicting the responses of lakes and impoundments to pollutants. Statistical and mass balance models are included. Knowledge of elementary calculus and statistics is recommended. Intensive. Offered on demand. 1 unit. *Chapra and Reckhow*

367. Laird, Norton Distinguished Visitor Series. Examination of concepts, practices, and policies employed in the management of industrial and public forests; discussion of the problems of large-scale forest management. 1 unit. *Staff*

372. Advanced Natural Resource Economics. Methods for evaluating conservation, development, and restoration of renewable and exhaustible environmental resources. The role of public goods and externalities in designing policies to sustain resource productivity and maintain environmental quality are introduced, and developed in more detail in 373. Topics include renewable resources, exhaustible resources, inter-generational equity, property rights, and optimal control. Consent of instructor required. 3 units. *Parks*

373. Advanced Environmental Economics. Examination of the economic measurement of environmental benefits and damages. Consideration of economic concepts for the design of environmental policies. Topics include externality theory, public goods, contingent valuation, and hedonic models. Consent of instructor required. 3 units. *Kramer*

385. Decision Theory and Risk Analysis. Bayesian decision theory, including probability, subjective probability, utility theory, value of sample information, and multiattribute problems. Applications of decision theory in resource and environmental policy-making. Ecological risk assessment, including case studies. Prerequisite: Environment 251 or equivalent. 3 units. *Maguire and Reckhow*

388. Seminar in Resource and Environmental Policy. Discussion of the political, legal, and socioeconomic aspects of public and private action in environmental quality control and management. Consent of instructor required. 2 units. *Staff*

389. Seminar in Conservation and Environmental History. Traces the evolution of conservation and environmental movements and the development of environmental ethics. History of agencies, industries, associations, and citizen groups as well as overall policies for land and resources. Comparison of parallel developments in Canada. Consent of instructor required. C-L: History 389. 3 units. *Steen*

393. Professional Writing. Techniques in writing grant proposals, technical reports, and environmental impact statements. (Given at Beaufort.) 2 units. *Staff*

395. Coastal Environmental Speaker Series. Examination of contemporary issues in coastal environmental management. Guest speakers. (Given at Beaufort.) 1 unit. *Staff*

The University Program in Genetics

Professors F. Ward, *Director* (immunology); Professors Amos (immunology), Antonovics (botany), Bastia (microbiology), Boynton (botany), Counce (cell biology), Endow (microbiology), Gillham (zoology), Greenleaf (biochemistry), Joklik (microbiology), Keene (microbiology), Kredich (medicine and biochemistry), Laurie (zoology), Modrich (biochemistry), Nevins (microbiology and genetics), Nicklas (zoology), Rausher (zoology), Roses (neurobiology), Shaw (chemistry), Steege (biochemistry), Uyenoyama (zoology), C. Ward (zoology), and Webster (biochemistry); Associate Professors Burdett (microbiology), Cullen (microbiology), Greene (biochemistry), Hsieh (biochemistry), Kreuzer (microbiology), Linney (microbiology), and Schachat (cell biology); Assistant Professors Been (biochemistry), Davis (cell biology), Dong (botany), Garcia-Blanco (microbiology), Garrett (biochemistry), Heitman (genetics and pharmacology), Hershfield (biochemistry), Horowitz (microbiology), Kaufman (biochemistry), Kohorn (botany), Markert (immunology), Ostrowski (microbiology), Pickup (microbiology), Sun (botany), Swenson (cell biology), Titus (cell biology), Vilgalys (botany), and Wharton (genetics and microbiology); Adjunct Professors Drake (National Institute of Environmental Health Sciences), Judd (National Institute of Environmental Health Sciences), Kunkel (National Institute of Environmental Health Sciences), and Resnick (National Institute of Environmental Health Sciences)

The University Program in Genetics provides a coherent course of study in all facets of biology related to genetics. This is an interdisciplinary program with a faculty drawn from several of the biological science departments (cell biology, biochemistry, botany, immunology, microbiology, neurobiology, and zoology). Graduate students registered in any of the biological sciences departments may apply to the faculty of the genetics program to pursue study and research leading to an advanced degree. It would be helpful if applicants for admission to the Graduate School indicated their interest in the genetics program at the time of application. Requests for information describing more completely the research interests of the staff, facilities, and special stipends and fellowships should be addressed to the Director, Genetics Program, Department of Immunology, Box 3010, Duke University Medical Center.

350. Genetics Colloquium. Lectures, discussion sections, and seminars on selected topics of current interest in genetics. Required of all students specializing in genetics. Prerequisites: a course in genetics and consent of instructor. 1 unit. *F. Ward and staff*

Genetics Courses Offered by Participating Departments

Biochemistry 215. Genetic Mechanisms. Prerequisite: introductory biochemistry. 3 units. *Webster and staff*

Biochemistry 268. Molecular Biology II: Nucleic Acids. Prerequisite: introductory biochemistry and Biochemistry 259, or consent of instructor. C-L: Cell Biology 268, Immunology 268, Microbiology 268, and The University Program in Cell and Molecular Biology. 4 units. *Steege and staff*

Botany 280. Principles of Genetics. C-L: Zoology 280. 3 units. *Antonovics, Boynton, Gillham, and Laurie*

Botany 285S. Ecological Genetics. Prerequisites: Biology 180 and Botany 286 or equivalents. 3 units. *Antonovics*

Botany 286. Evolutionary Mechanisms. Prerequisite: Biology 140L and a course in genetics or equivalents. C-L: Zoology 286. 3 units. *Antonovics (botany) and Uyenoyama*

Immunology 336. Contemporary Topics in Immunogenetics. 2 units. *Amos and Ward*

Zoology 281. DNA, Chromosomes, and Evolution. Prerequisites: an introductory course in genetics or cell or molecular biology, or consent of instructor. 3 units. *Laurie and Nicklas*

Zoology 283. Molecular Genetics of Organelles. C-L: Botany 283. 3 units. *Boynton (botany) and Gillham*

Zoology 288. Mathematical Population Genetics. Prerequisites: calculus, statistics, and linear algebra recommended. 3 units. *Uyenoyama*

Geology

Professor Corliss, *Chair* (338 Old Chemistry); Professor Heron, *Director of Graduate Studies* (205 Old Chemistry); Professors Barber, Haff, Johnson, Karson, Kay, Livingstone, Perkins, Pilkey, and Schlesinger; Associate Professors Baker and Malin; Assistant Professors Boudreau, Howd, Klein, Lozier, and Rojstaczer

The Department of Geology offers graduate work leading to the M.S. and Ph.D. degrees. An undergraduate degree in geology is not a prerequisite for graduate studies. For the M.S. degree a student must have had or must take a summer field geology course (or equivalent experience), mineralogy, igneous and metamorphic rocks, stratigraphy or sedimentation, and structural geology. In addition, the student must have had one year of college chemistry, one year of college physics, and mathematics through calculus. Requirements for the Ph.D. are decided on an individual basis. Graduate courses and research in the Department of Geology provide specialized training in the fields of coastal geology, earth surface processes and geomorphology, facies analysis, geological oceanography and limnology, geophysics, high-temperature geochemistry, hydrogeology, igneous petrology, low-temperature geochemistry, micropaleontology, paleoceanography, sedimentary petrology, seismology, and structural geology/tectonics.

For Seniors and Graduates

200. Beach and Coastal Processes. The study of sedimentary processes and geomorphology of nearshore environments with emphasis on both developed and undeveloped barrier island systems. 3 units. *Pilkey*

201S. Coastal Processes. Waves and currents in the nearshore zone and their role in beach evolution. Linear wave theory and models for beach evolution. Other topics include nearshore currents, tides, estuarine circulation, and field techniques for measurement of nearshore morphology and fluid motions. Term project required. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Environment 222S and Marine Sciences. 2 units. *Howd*

203. Physical Oceanography. Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf, and tropical circulations. Prerequisites: Mathematics 31 and 32 or consent of instructor. C-L: Environment 290 and Mechanical Engineering 290. 3 units. *Lozier*

205S. Geological Oceanography. The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 206S. (Given at Beaufort.) C-L: Environment 291S and Marine Sciences. 3 units. *Johnson*

206S. Principles of Geological Oceanography. Geological aspects of the ocean basins including coastal to deep water sediment types and sedimentation processes, sea floor physiography and environmental problems. 3 units. *Pilkey*

208S. Paleooceanography. Geology, paleooceanography, and evolution of the oceans, ocean basins, and marine biota based on analysis of deep-sea sedimentary sequences. 3 units. *Corliss*

209. Climatic Change. Record of changing climate on earth, as determined from the analysis of deep sea sediments, ice cores, lake sediments, and tree rings. (Given at Beaufort.) C-L: Marine Sciences. 4 units. *Johnson*

212. Carbonate Facies Analysis: Recent and Ancient. Origin, distribution, and diagenetic alteration of recent carbonate sediments and their ancient analogs. Prerequisite: Geology 110L. 3 units. *Perkins*

214S. Sedimentary Petrography. Descriptive and interpretive analysis of sediments and sedimentary rocks in thin section, with an emphasis on diagenesis. Consent of instructor required. 3 units. *Perkins*

215. Clastics Facies Analysis: Recent and Ancient. Modern clastic depositional systems and their ancient analogs. Prerequisite: Geology 110L. 3 units. *Heron*

216. Field Analysis of South Florida Carbonates. Analysis of recent sediments and organisms and their Pleistocene analogs. One-week field trip. Pass/fail grading only. Prerequisite: Geology 110L or consent of instructor. 1 unit. *Perkins*

218. Geological Fluid Mechanics. Physical properties of fluids. Continuity, momentum, and energy principles. Laminar and turbulent flow; potential flow; open channel flow. Applications to stream and watershed hydraulics, sediment transport, and other geological phenomena. Prerequisites: Mathematics 31 and 32, Physics 41L and 42L, or Engineering 75L. 3 units. *Haff*

219. Sediment Transport. The processes by which wind and water move sedimentary material. Prerequisites: Civil Engineering 122L or Geology 41 and 218. 3 units. *Haff*

220. Earth Surface Processes and Geomorphology. The origin, nature, and significance of natural features on the earth's surface. Prerequisites: open to graduates and advanced undergraduates with consent of instructor. 3 units. *Haff*

221. Hydrogeology. Theory of groundwater flow and solute transport with application to geologic processes. Prerequisite: Chemistry 12L, Physics 42L or 52L, or consent of instructor. 3 units. *Rojstaczer*

222L. Techniques in Environmental Data Analysis. Introduction to techniques commonly used by environmental scientists for the study of spatial and cross-spectral analysis and empirical orthogonal functions. Emphasis on developing a hands-on understanding of the methods and correct interpretation of results. Lectures and laboratory. Term project required. (Given at Beaufort.) Prerequisites: Mathematics 31 and 32. C-L: Environment 252L and Marine Sciences. 4 units. *Howd*

223. Numerical Methods in Hydrogeology. Finite difference and finite element methods to solve partial differential equations encountered in hydrogeology. Prerequisite: Computer Science 53, Geology 221, Mathematics 103, or consent of instructor. 3 units. *Rojstaczer*

225S. Advanced Topics in Hydrogeology. Hydrologic controls on the chemical and physical state of the earth's crust. Prerequisite: Geology 221 or consent of instructor. 3 units. *Rojstaczer*

233S. Oceanic Crust and Ophiolites. Structure, tectonics, petrology, and geochemistry of oceanic spreading environments and ophiolite complexes. Prerequisites: Geology 106L and 130 or consent of instructor. 3 units. *Karson*

237S. Structure and Evolution of the Appalachian Orogen. Overview of sedimentation, deformation, and metamorphism responsible for the development of the Appalachian Mountain Belt from Newfoundland to Alabama in the context of plate tectonics. Prerequisites: Geology 106L, 110L, and 130 or consent of instructor. 3 units. *Karson*

249. Marine Micropaleontology. Introduction to marine microfossils, basic principles of micropaleontology and stable isotope geochemistry with applications to paleoceanography. Lectures and laboratory. 3 units. *Corliss*

251. Introduction to Geophysics. A survey of the earth's heat flow, gravitational, magnetic and electrical potential fields, and global seismology. Derivation of basic relationships and their application to the solution of geological problems. Prerequisite: upper-division mathematics or science courses. 3 units. *Malin*

252. Seismic Exploration of the Lithosphere. A survey of seismic wave generation, propagation, detection, analysis, and interpretation in the continental and oceanic lithosphere with practical applications to geological and industrial problems. Prerequisite: upper-division mathematics or science courses. 3 units. *Malin*

255. Theoretical Geophysics I: Diffusion and Wave Motion in the Earth, Part I. Theoretical and practical quantitative methods for seismological and groundwater research. Differential and integral equations for diffusion and wave motion; analytical solutions and numerical methods. Elementary continuum mechanics. Time series analysis. Emphasis varies depending on enrollment. Prerequisite: enrollment in an advanced degree program in earth sciences or related fields, or consent of instructors. 3 units. *Malin and Rojstaczer*

256. Theoretical Geophysics II: Diffusion and Wave Motion in the Earth, Part II. Theoretical and practical quantitative methods for seismological and groundwater research. Differential and integral equations for diffusion and wave motion; analytical solutions and numerical methods. Elementary continuum mechanics. Time series anal-

ysis. Emphasis varies depending on enrollment and the contents of Geology 255. Prerequisite: Geology 255 or consent of instructors. 3 units. *Malin and Rojstaczer*

258S. Advanced Topics in Geophysics: Interdisciplinary Approaches to Problems in Tectonics, Seismology, and the Environment. Crustal structure of the western United States; use of seismic reflection and microearthquake data for imaging active geological processes, earthquake prediction; scattering of seismic waves. Consent of instructor required. 3 units. *Malin*

260S. Applied Subsurface Stratigraphy. Overview and application of tools, techniques, and procedures for analysis of subsurface strata. Logging methods for cuttings and cores, principles and application of wire-line logs, interpretation of seismic sections, mapping and correlation procedures, and the application of computers to stratigraphic analysis. Prerequisite: Geology 110L. 3 units. *Perkins*

269. Theoretical Geochemistry. Introductory thermodynamics applied to geologic problems through understanding of phase equilibrium. Prerequisites: Geology 105L (may be concurrent) and Mathematics 32. 3 units. *Boudreau*

271. Isotope Geochemistry. Theory and applications of stable and radioactive isotope distributions in nature. Prerequisites: Chemistry 12L and Mathematics 32. 3 units. *Baker*

272. Biogeochemistry. Processes controlling the circulation of carbon and biochemical elements in natural ecosystems and at the global level, with emphasis on soil and surficial processes. Prerequisite: Chemistry 12L or equivalent. 3 units. *Schlesinger*

285S. Layered Intrusions. Survey of layered igneous intrusions and current theories on crystallization and other processes in mafic magmas. Offered alternate years. Prerequisites: Geology 105L and 106L or consent of instructor. 3 units. *Boudreau*

292. Computer Methods in Geology. Techniques used in the geological sciences including simulation and forward modeling, inverse and least squares methods, statistical methods and exploratory data analysis as well as graphics. Prerequisites: Computer Science 53 and Mathematics 32, or consent of instructor. 3 units. *Staff*

295S. Advanced Topics in Geology. Topics, instructors, and credits to be arranged each semester. Variable credit. *Staff*

For Graduates

371, 372. Advanced Topics in Geology. To meet the individual needs of graduate students for independent study in various environmental sedimentary fields. Variable credit. *Staff*

COURSES CURRENTLY UNSCHEDULED

204. Chemical Oceanography

217. Field Analysis of Ancient Sedimentary Sequences

230S. Advanced Topics in Structural Geology and Tectonics

236S. Lithosphere Plate Boundaries

239S. Advanced Topics in Structural Geology and Tectonics

270. Sedimentary Geochemistry

275. Economic Geology

281S. Advanced Topics in Igneous Petrology

283S. Experimental Methods in Geology

German Studies Program

Professor Rolleston, *Chair* (102 Languages); Associate Professor Morton, *Director of Graduate Studies* (07 Languages); Professors Alt (German), Antonovics (botany), Bernstein (law), Borchardt (German), Counce (cell biology), Gillis (public policy), Herzog (divinity), Hillerbrand (religion), Jameson (literature), Kitschelt (political science), Klopfer (zoology), Osborn (religion), W. Scott (history), Seebass (music), Silbiger (music), Steinmetz (divinity), and Todd (music); Associate Professors Berger (divinity), Gillespie (political science), Koonz (history), Lahusen (Slavic), Robisheaux (history), and Surin (religion); Assistant Professors Cernuschi (art), Coles (political science), Gilliam (music), Hell (German), Janoski (sociology), Van Miegroet (art), Pfau (English), Rasmussen (German), and Stiles (art); Adjunct Associate Professor Ward (philosophy)

The Interdisciplinary Program in German Studies offers graduate work leading to the A.M. and Ph.D. degrees. A student's program will be structured among four general disciplinary areas: history and society, literature and linguistics, fine arts and music, philosophy and theory. All students will do some course work in each of the areas, with additional basic requirements in literature and linguistics. A student will elect one of the four areas for comprehensive study; the dissertation topic will normally emerge from that specializing process, and will be grounded in the appropriate disciplinary methodology. Prior to admission to Ph.D. candidacy, students must demonstrate a reading knowledge of at least one language other than English or German. Determination of which language or languages fulfill this requirement will depend on the student's chosen area of concentration and specific research plans.

A qualifying examination, to be taken in three parts, must be passed before a student may proceed to candidacy and the writing of the dissertation. Part I, to be taken at the end of the first full year of study, will be a general examination devoted to major issues and topics in German history and culture. (Students concluding their studies at this point will be asked to submit an A.M. essay and to take a final examination for the master's degree.) Part II, the Ph.D. preliminary examination, will be devoted to a single historical period, problem, or genre in the student's chosen area of concentration and will be based on a reading list approved by the student's chosen faculty committee. For Part III, to be devoted to the dissertation proposal, the student will evolve and master the bibliography for the anticipated dissertation, articulate the methodological and research problems involved, and present a substantial sample of the project.

Students in other departments needing a course in German for Reading Knowledge should see the Undergraduate Bulletin.

Courses in the Department of Germanic Languages and Literature

200S. Proseminar: Introduction to Literary Criticism. Literary theory within the framework of Germanistik, combining a survey of the major critical approaches which developed after 1945 with the discussion of several paradigmatic readings of literary texts. Approaches studied include New Criticism, hermeneutics, Marxist critical theory, reception aesthetics, structuralism, poststructuralism, and feminist literary criticism(s). 3 units. *Hell*

201. Introduction to Middle High German: The Language of the German Middle Ages and Its Literature. Fundamentals of medieval German language acquired through readings in the original Middle High German of Arthurian romance, heroic epic, and courtly poetry. C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

202S. Medieval Seminar. Topics may include: heroic epic, courtly epic, medieval poetics, German lyric poetry from the twelfth to the fifteenth century. Solid reading knowledge of modern German and some knowledge of medieval German required. C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

203S. Sex, Gender, and Love in Middle High German Literature. Historical contexts for emergence of courtly love and the role of desire and interpretation in Gottfried von Strassburg's *Tristan und Isolde*, courtly love lyric, "maere." C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

210S. Renaissance and Reformation. The development of "personality" from "type" to "individual" in German culture in the great transition from medieval to early modern times, with examples from literature, history, art, architecture, music, science, and religion. Emphasis on the Italian connection, northern mysticism, Prague in the fourteenth century, fifteenth-century poetry and prose, and Luther. C-L: Medieval and Renaissance Studies. 3 units. *Borchardt*

215S. German Baroque Literature. German literature of the grand gesture, of performance, of public posture; poetry of rhetoric; prose of the scoundrel, adventurer, and ne'er-do-well. C-L: Medieval and Renaissance Studies. 3 units. *Borchardt*

220S. Reason and Imagination: The German Eighteenth Century. Advanced study of selected topics, from the beginnings of Enlightenment to the transition to Romanticism. 3 units. *Morton*

225S. Introduction to Goethe. Major works of lyric, narrative, drama, and theory, throughout Goethe's career. 3 units. *Morton*

226S. Goethe's Faust. Goethe's masterpiece and life's work, conceived as a summation of Western literature and mythology for the modern age. 3 units. *Morton*

227S. Goethe Seminar. Selected texts or other aspects of Goethe's life and work not treated in German 225S or 226S. Topics may include autobiography, scientific writings, longer novels, late lyrics, literary theory and criticism, as well as others. 3 units. *Morton*

229S. Schiller: Aesthetic Theory and Practice. The nature and function of the artist and the work of art, in Schiller's essays, poetry, and dramas. 3 units. *Borchardt, Morton, or Rolleston*

230S. German Romanticism. The emergence in the 1790s of a new cultural language: categories of self, history, interpretation, irony, and revolution. Theory, fiction, and poetry by Novalis, the brothers Schlegel, Tieck, Brentano, Eichendorff, Hoffmann, and Heine. 3 units. *Rolleston*

232S. The Lyric: Goethe to the Present. Poetry and its cultural meanings from versions of the modern *Ich* generated by Goethe, Hölderlin, and the romantics to the ironic new subjectivity of the 1970s. Emphasis on Mörike, Heine, Droste-Hülshoff, Rilke, Benn, Celan, Enzensberger, and Karin Kiwus. 3 units. *Rolleston*

233S. German Theater as Anti-Drama. The story of modern and postmodern drama with emphasis on Lenz, Büchner, Grabbe, Schnitzler, Brecht, Frisch, Dürrenmatt, Handke, expressionist drama, and Piscator's political theater. 3 units. *Alt*

235S. Nineteenth-Century German Literature. Topics vary: poetry, prose, drama; Kleist, Heine, Büchner, Keller, Meyer, Gotthelf, Grillparzer, Mörike, Storm, Freytag, Hebbel, Fontane. 3 units. *Alt*

236S. Empires of the Mind: Nineteenth-Century German Ideas. Selected topics in politics, religion, society, and history in the nineteenth century: Heine, Hegel, Schopenhauer, Feuerbach, Marx, Nietzsche, Burckhardt, Treitschke, Ranke, D. F. Strauss, Tönnies, Weber, Freud. 3 units. *Alt*

244S. International Expressionism. See C-L: Art 244S. 3 units. *Cernuschi and Rolleston*

245S. The Twentieth Century. The major movements and writers from the expressionists, Thomas Mann, Kafka, Rilke, and Brecht, to Böll, Grass, Handke, and Christa Wolf. Emphasis on relations between text and history: World War I, Weimar, Third Reich, and the struggle to integrate past and present in post-Holocaust literature. 3 units. *Rolleston*

246. German Letters in the Third Reich and in Exile. German literature, drama, and film inside and outside Nazi Germany. Theoretical readings in Bloch, Benjamin, and others. 3 units. *Hell*

247S. Postwar German Literature. The development of German literature after 1945. Topics vary: German literature between 1945 and the founding of the two states; the GDR novel and the question of realism; GDR drama after Brecht; West German literature. 3 units. *Hell*

250S. German Literature and Classical Antiquity. The reception of Greece and Rome in German letters; the triumph and decline of classical rhetoric; the idea of the "classical"; antiquity as model and reproach. 3 units. *Borchardt*

260. History of the German Language. Phonology, morphology, and syntax of German from the beginnings to the present. C-L: Medieval and Renaissance Studies. 3 units. *Rasmussen*

261. Second-Language Acquisition Theory and Practice. Modern teaching techniques; problems in the teaching of German on the secondary and college levels. Analysis and evaluation of textbooks, related audiovisual materials, and computer programs. 3 units. *Staff*

262. Applied Linguistics. The application of modern linguistic principles to a systematic study of the phonetics, morphology, and syntax of modern German. 3 units. *Staff*

265, 266. Elementary German for Business and Law. An accelerated course providing the fundamentals of German grammar, syntax, and culture, with special attention to the terminology of business and law. Exposure to audio- and computer-assisted instructional materials. Open only to graduate and professional school students. 3 units each. *Staff*

270. Consciousness and Modern Society. The blend of philosophy, literature, and sociology in German thinking about actual and possible societies. The idea of consciousness as producing involvement, detachment, or transformation. Marx, Nietzsche, Lukacs, Freud, Marcuse, Benjamin, Adorno, and Habermas. Taught in English. 3 units. *Rolleston*

300S. The Discipline of *Germanistik*: A Historical Survey. A study of trends in scholarly criticism within the context of German culture and politics beginning in the 1810s with the origins of *Germanistik* as a university discipline. Topics may include: the invention of philology and the romantic enterprise; positivism and *Geistesgeschichte*; the politics of *Germanistik*, 1933-45; *Germanistik* in Europe and the United States after 1945. 3 units. *Alt, Borchardt, or Rasmussen*

COURSES CURRENTLY UNSCHEDULED

231S. Romantic Outsiders

240S. Naturalism and Beyond: The Turn of the Century

241S. Nietzsche

242S. Expressionism

- 251S. Germanic Mythology and Its Critics
- 252S. The Mystical Tradition
- 253S. The Image of America in German Literature
- 254S. Literature by Women
- 255S. Paradigmatic Issues in Literary Theory
- 271S. Contemporary Theory and the German Tradition
- 272S. The German Literature of Fantasy
- 273S. Franz Kafka and Thomas Mann
- 274S. The Image of America in German Literature
- 275S. German Women Writers
- 321, 322. Germanic Seminar

GERMAN STUDIES COURSES IN OTHER DEPARTMENTS

Art and Art History

- 243S. Topics in Netherlandish and German Art
- 248. Art of the Netherlands in the Fifteenth Century
- 254. German Art in the Fifteenth and Sixteenth Centuries
- 256. Art of the Southern Netherlands in the Seventeenth Century
- 258-259. Art and Cultural History of Flanders and the Netherlands from the Fifteenth through the

Seventeenth Centuries

- 277S. Topics in Art since 1945
- 282. The Concept of Expressionism
- 283S. Topics in Modern Art
- 299S. Critical Theory

History

- 204. German Society, 1914-1945
- 253S, 254S. European Diplomatic History, 1871-1945
- 258S. Social Conflict in Weimar and Nazi Germany

Literature

- 252. Criticism and Literary Theory in the Twentieth Century
- 281. Paradigms of Modern Thought
- 283. Modernism
- 285. Literature and Ideology
- 293. Seminars in Literature and History

Music

- 222. Music in the Middle Ages
- 223. Music in the Renaissance
- 224. Music in the Baroque Era
- 225. Music in the Classic Era
- 226. Music in the Nineteenth Century
- 227. Music in the Twentieth Century
- 236. Nineteenth-Century Piano Music

Philosophy

- 231S. Kant's Critique of Pure Reason
- 235S. Nineteenth-Century German Philosophy

Political Science

- 216S. Evolution of European Marxism
- 225S. Topics in Comparative Government and Politics: Western Europe
- 228S. Nineteenth- and Twentieth-Century Political Philosophy

- 236S. Hegel's Political Philosophy
- 239. Comparative History and International Studies
- 247. Politics and Philosophy of Self and Other

Religion

- 228. Twentieth-Century Continental Theology
- 231S. Seminar in Religion and Contemporary Thought
- 232S. Religion and Literary Studies
- 236. Luther and the Reformation in Germany
- 248. The Theology of Karl Barth
- 274A. Philosophies, Sciences, and Theologies of the European Enlightenment: Descartes to Kant
- 274B. Philosophies, Sciences, and Theologies of the European Enlightenment: Schleiermacher to Troeltsch
- 297. Philosophical and Theological Discourses on Modernity
- 320. Theology, Power, and Justice
- 322. Nineteenth-Century European Theology
- 339. The Radical Reformation

Divinity School Courses

- 201. Christian Thought in the Middle Ages
- 241. Problems in Reformation Theology
- 262. Marxist Ideology and Christian Faith
- 272. Theology of Paul Tillich
- 303. Philosophical Method in Religious Studies
- 328. Twentieth-Century European Theology
- 338. Calvin and the Reformed Tradition
- 344. Zwingli and the Origins of Reformed Theology

Health Administration

A concentration in Health Administration is offered through the Masters in Business Administration degree program of the Duke University Fuqua School of Business. Please contact that school directly for more information.

History

Professor Chafe, *Chair* (215 Carr); Professor Wood, *Director of Graduate Studies* (212A Carr); Professors Cahow, Cell, Davis, Dirlik, Durden, Gaspar, Gavins, Goodwyn, Gordon, Herrup, Hewitt, Keyssar, Kuniholm, Lerner, Mauskopf, Miller, Oates, Reddy, Richards, Roland, W. Scott, TePaske, Thompson, and Witt; Associate Professors English, Ewald, James, Koonz, Nathans, Neuschel, and Robisheaux; Assistant Professors French, Green, J. Scott, Thorne, and Wigen; Professors Emeriti Colton, Ferguson, Franklin, Holley, Parker, Preston, Ropp, A. Scott, Watson, and Young

The Department of History offers graduate work leading to the A.M. and Ph.D. degrees. Candidates for the A.M. degree must have a reading knowledge of at least one ancient or modern foreign language related to their programs of study and have completed successfully a substantial research paper, or two seminar papers, normally the product of a year's seminar or two semester courses. The paper(s) must be examined and approved by three readers: the supervising professor and two other professors from the graduate staff. Students anticipating a May degree must have their papers read and approved by April 15; those anticipating a September degree must have their papers read and approved by August 1.

Candidates for the degree of Doctor of Philosophy prepare themselves for examinations in four fields, at least three of which shall be in history. The choice of fields is determined in consultation with the student's supervisor and the director of graduate studies. The department offers graduate instruction in the broad historical areas of North America; Latin America; Great Britain and the Commonwealth; ancient, medieval, and Renaissance Europe; modern Europe; Russia; Japan; China; South Asia; military; history of science, technology, and medicine; and in the comparative and thematic fields of women's history, environmental history, diplomatic history, labor history, and slave

societies. The candidate for the Ph.D. degree must have a reading knowledge of two foreign languages to be picked in conjunction with the candidate's supervisor. In certain cases, an alternative to the second language may be chosen if approved by both the candidate's supervisor and the director of graduate studies. Such an alternative must take the form of successful completion of a course or courses which would appreciably increase the candidate's methodological proficiency, such as a graduate course in statistics, archaeology, demography, numismatics, cartography, or a summer training program for developing methodological skills. A course or courses in a discipline outside history—for example, anthropology, literature, sociology, political science, ecology, geography—will not usually qualify as an alternative to a second language. Whether satisfied by two languages or by one language and an alternative, the requirement must be met prior to the preliminary examination.

Ancient History. For courses in ancient history which may be taken for credit in either history or classical studies, see Classical Studies.

For Seniors and Graduates

Students may receive credit for either semester of a hyphenated course at the 200 level without taking the other semester if they obtain written consent from the instructor.

201S. The Russian Intelligentsia and the Origins of the Revolution. Origin and dynamics of the Russian revolutionary movement, the intelligentsia, and the emergence of the labor movement. 3 units. *M. Miller*

202S. The Russian Revolution. An analysis of the Bolshevik seizure of power in 1917 and the establishment of a revolutionary society and state during the 1920s. 3 units. *M. Miller*

203. Topics in Modern World Environmental History. Human effects upon the natural environment; case studies and a synthetic global perspective. 3 units. *Richards*

204. German Society, 1914-1945. Investigation of daily life at the grass roots, demographic shifts, organizational activity, ethnic conflict, political mobilization, and generational conflicts. 3 units. *Koonz*

205S. Gender and War. An interdisciplinary examination of the relationship between war and gender. Perspectives from literature, history, art, anthropology, zoology, and political science. C-L: Asian and African Languages and Literature 205S. 3 units. *Cooke and Roland*

206. Origins of Afro-America. A comparative and interdisciplinary approach to early history of Africans in the Western hemisphere. Uses anthropological, linguistic, and archeological literature in addition to historical studies to examine the origins of the diverse African-American cultures of the Americas. 3 units. *J. Scott*

207S. Geographic Perspectives in History I: Western Europe and the Americas. Connections between history and geography. Regional, spatial, and environmental analyses of social development in Western Europe and the Americas. 3 units. *Wigen*

208S. Geographic Perspectives in History II: Asian and Pacific Worlds. Connections between history and geography. Regional, spatial, and environmental analyses of social development in Asia and the Pacific region. 3 units. *Wigen*

209S. Race, Class, and Gender in Modern British History. The intersection between gender, race, and class identities in British history since the eighteenth century. The parallels and overlaps as well as the disjunctures and distinctions between these different modes of power in a period of tremendous economic, social, and political change resulting from industrialization and imperial expansion. Questions and issues

include the impact of industrialization on gender as well as class consciousness, the role of women, the middle classes and the working classes in the campaign against slavery, British workers' reactions to the "scramble" for colonies, the attitudes and activities of British women in the empire, and sexuality and the evolution of racist discourse. 3 units. *Thorne*

210S. Anthropology and History. Prerequisite: major in history, one of the social sciences, or comparative area studies; or graduate standing. See C-L: Cultural Anthropology 207S. 3 units. *Reddy*

211A. History of Medicine in the Southern United States. The social history of disease and medical practice in the southern United States from the colonial era to World War II. Topics will include the impact of disease on the region's settlement and economy, slave health, the role of "alternate practitioners," and the growing federal presence in the post-Reconstruction South. 3 units. *Humphries*

214. Class, Public Opinion, and the French Revolution. The current state of the ongoing controversies over the origins and character of the first modern social revolution. 3 units. *Reddy*

215S. The United States in International Relations: The Eighteenth and Nineteenth Centuries. 3 units. *Davis*

216S. United States Diplomacy, 1890-1945. 3 units. *Davis*

217. Problems in American Colonial History. 3 units. *J. Scott*

219S, 220S. History of Science and Technology. The interaction of science and technology in the Western world from earliest times to the present. 3 units each. *Mauskopf and Roland*

221. Topics in the Social and Economic History of Europe, 1200-1700. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

222. Problems in the Intellectual History of the European Renaissance and Reformation. Prerequisites: History 151A, 151B and reading knowledge of German, French, or Italian. C-L: Medieval and Renaissance Studies. 3 units. *Witt*

223S, 224S. The World Wars. The causes, course, and consequences of World Wars I and II, from military, political, and economic perspectives; the legacy of World War II; special emphasis on understanding the experience of total war—not only for the individual soldier but for whole societies. 3 units each. *Biddle*

226. Topics in the Labor History of the United States. 3 units. *Keyssar*

227-228. Recent United States History: Major Political and Social Movements. C-L: Women's Studies. 6 units. *Chafe*

230S. Populism in Latin America. An examination of the various theoretical frameworks developed for Latin American populism, followed by case studies focusing on issues such as the emergence of a modernizing state, the role of the masses in populist movements, and the class content and ideological and cultural parameters of such movements. 3 units. *James*

231S. Readings in Latin American Colonial History. 3 units. *TePaske*

233S. Slave Resistance and Social Control in New World Societies. The operation of slave societies in the Americas from the sixteenth to the nineteenth centuries focusing on master-slave relations and slave resistance. 3 units. *Gaspar*

234S. Political Economy of Development: Theories of Change in the Third World. See C-L: Political Science 234S; also C-L: Cultural Anthropology 234S and Sociology 234S. 3 units. *Staff*

235S. The Antebellum South. The economic, political, and social aspects of life in the South, 1820-1860. 3 units. *S. Nathans*

237S. Europe in the Early Middle Ages. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

238S. Europe in the High Middle Ages. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

239S. History of Socialism and Communism. Problems in the origins and development of socialist and communist movements. 3 units. *Lerner*

241S-242S. United States' Constitutional History. 241S: to 1865; 242S: 1865 to present. 6 units. *Cahow*

243-244. Marxism and History. Critical examination of Marxist theory and its relevance to historical understanding and explanation. 6 units. *Dirlik*

245, 246. Social and Intellectual History of China. 3 units each. *Dirlik*

247. History of Modern India and Pakistan, 1707-1857. 3 units. *Richards*

248. History of Modern India and Pakistan, 1857 to the Present. 3 units. *Richards*

249-250. Social and Intellectual History of the United States. The interplay of ideas and social practice through the examination of attitudes and institutions in such fields as science and technology, law, learning, and religion. 6 units. *Holley*

251A. Topics in Intellectual History of Europe, 1250-1450. C-L: Medieval and Renaissance Studies. 3 units. *Witt*

251B. Topics in Intellectual History of Europe, 1450-1650. C-L: Medieval and Renaissance Studies. 3 units. *Witt*

252. Construction of China in European and American Literature. An examination, starting with Marco Polo's account of China, of representations of China in Euro-American writing toward an understanding of a Euro-American discourse on China. Emphasis on fiction, but consideration as well of the relationship between fictional and nonfictional writing (especially history, geography, and travelogue). While the approach is historical, contemporary representations of China are of primary concern. 3 units. *Dirlik*

253S, 254S. European Diplomatic History, 1871-1945. Origins of the First and Second World Wars, the diplomacy of the wars, and the peace settlements which followed them. 253S: 1871-1918; 254S: 1919-1945. 3 units each. *W. Scott*

256. Modern Literature and History. See C-L: French 256. 3 units. *Orr*

257. Comparative Latin America Labor. An interdisciplinary examination of the monographic literature on Latin-American labor in the twentieth century. 3 units. *French*

258S. Social Conflict in Weimar and Nazi Germany. The interactions between emancipation and backlash; military defeat and patriotism; political equality and biopolitics; dissent and repression; and among propaganda, bureaucratic chaos, and police terror. 3 units. *Koonz*

259. Archaic Greece. See C-L: Classical Studies 221. 3 units. *Oates or Rigsby*

260. Fifth and Fourth Century Greece. See C-L: Classical Studies 222. 3 units. *Oates or Rigsby*

261. Alexander and the Hellenistic World. See C-L: Classical Studies 223. 3 units. *Oates*

262. Problems in Soviet History. Studies in the background of the Revolution of 1917 and the history and politics of the Soviet state. 3 units. *Lerner*

263. The Roman Republic. See C-L: Classical Studies 224. 3 units. *Boatwright or Rigsby*

264. The Roman Empire. See C-L: Classical Studies 225. 3 units. *Boatwright*

265S. Problems in Modern Latin American History. 3 units. *Staff*

267S. England in the Sixteenth Century. C-L: Medieval and Renaissance Studies. 3 units. *Herrup*

268S. England in the Seventeenth Century. C-L: Medieval and Renaissance Studies. 3 units. *Herrup*

269S-270S. British History, Seventeenth Century to the Present. Historiography of social structure and social change: English Revolution, party, the Industrial Revolution, class and class consciousness, Victorianism, and the impact of war in the twentieth century. 6 units. *Cell*

273S, 274S. Topics in the History of Science. Critical stages in the evolution of scientific thought. 3 units each. *Mauskopf*

277S. The Coming of the Civil War in the United States, 1820-1861. 3 units. *Durden*

278S. The Civil War in the United States and Its Aftermath, 1861-1900. 3 units. *Durden*

279, 280. Health, Healing, and History. The development of medicine within the broader cultural context from prehistory to the twentieth century. 3 units each. *English*

281S. United States' Diplomacy since 1945. 3 units. *Davis*

282S. Canada. A research seminar for advanced students familiar with Canada. Topics vary each semester; recent perspectives have included nationalism, Canadian-American relations, regionalism in the Maritimes and the West, and cross-border environmental issues, among others. C-L: Cultural Anthropology 282S, Economics 282S, Political Science 282S, and Sociology 282S. 3 units. *Cahow or Thompson*

285S, 286S. Oral History. Research on race relations and civil rights in the United States in the twentieth century using techniques of oral history. Consent of instructor required. 3 units each. *Chafe and Goodwyn*

287S. History and Social Theory. Contemporary theories of social order, social change, and revolution. 3 units. *Goodwyn*

Required Courses for Graduates

301-302. Research Seminar in History. This seminar is required of all entering first-year doctoral candidates in history. 6 units. *Staff*

312. Seminar in the Teaching of History in College. This course is intended to acquaint students with the problems involved in teaching history in college. Required of all candidates for the degree of Doctor of Philosophy who are in residence for two years at Duke. As an alternate method of meeting this requirement, a graduate student

may, in cooperation with a member of the faculty, serve a one-semester teaching apprenticeship. Supervised by director of graduate studies. No credit.

314. Historical and Social Science Methodology. Methods used in historical research with emphasis upon the various social science approaches. Required of all candidates for the Ph.D. degree who are in residence for two years at Duke University. 3 units. *Staff*

Colloquia and Seminars for Graduates

305. The British Empire: Recent Interpretations. Colloquium emphasizes recent interpretations of the following topics: (1) the imperialism of free trade; (2) nineteenth-century India; (3) the new imperialism; (4) nationalism and decolonization (India and Africa); (5) Empire to Commonwealth; (6) imperialism and gender. 3 units. *Staff*

309S, 310S. Seminar in Afro-American History, 1900 to the Present. Historiography and research on the black experience and race relations in the age of segregation, during the Civil Rights Movement, and in the post-civil rights era. 3 units each. *Gavins*

320S. The Working Class in the United States. 3 units. *Keyssar*

325S. Topics in Modern American Political and Social History. 3 units. *Keyssar*

326S. Introduction to Military History. Critical reading and discussion of classic works and studies representative of the major genres in the field. 3 units. *Biddle and Roland*

330S. Selected Topics in Brazilian History. 3 units. *French*

335S. Comparative Labor History. Selected topics and methodological and historiographical controversies in the labor history of two or more world regions. 3 units. *Fink and French*

340S. Topics in Modern Latin American Social and Political History. Empirical case studies and methodological and historiographical themes in nineteenth- and twentieth-century Latin America. 3 units. *James*

351-352. Colloquia. Each colloquium deals with an aspect of history by means of readings, oral and written reports, and discussion, with attention to bibliography. *Ad hoc* colloquia may be worked out during registration in the various fields represented by members of the graduate faculty. In some instances, students may take the equivalent of a research seminar in conjunction with the colloquium and will be credited with an additional 6 units by registering for 371.1-372.1, etc. C-L: Women's Studies. Variable credit.

371-372. Research Seminars. To be taken either in conjunction with colloquia listed above or by special arrangement with appropriate graduate instructors when research seminars in a desired area are not offered. These seminars do not appear on the official schedule of courses. 6 units. *Staff*

389. Seminar in Conservation and Environmental History. Traces the evolution of conservation and environmental movements and the development of environmental ethics. History of agencies, industries, associations, and citizen groups as well as overall policies for land and resources. Comparison of parallel developments in Canada. Consent of instructor required. C-L: Environment 389. 3 units. *Steen*

Independent Study

399. Special Readings. Supervised independent study and reading. Consent of instructor required. 3 units. *Staff*

N.B. For the most current listing of scheduled courses, please refer to the most recent Duke University official schedule of courses printed twice a year.

COURSES CURRENTLY UNSCHEDULED

212. The American Indian in the Revolutionary Era, 1760-1800

266. Late Antiquity

284S. Feminist Theory and the Social Sciences

The Master of Arts Program in Humanities

Professor A. Leigh DeNeef, *Director* (English)

The Master of Arts Program in Humanities is an interdepartmental program and is tailored to the needs of individual students. The candidate defines a theme and selects appropriate course work with the aid and approval of a supervising committee. Thirty units of course work and proficiency in a foreign language are required for completion of the program. The degree may be earned with or without a thesis. The candidate who chooses not to submit a thesis will submit instead at least two substantial papers arising from course work for review by committee members, and meets with them to discuss his or her program in a final master's colloquium.

The program is open to holders of undergraduate degrees in any discipline who can demonstrate sufficient background in humanities to permit study at the graduate level. Admission is by regular application to the Graduate School. Students may enroll full time or part time (minimum of 3 units per term). Students considering entering the program may enroll in an appropriate graduate course or courses through the Office of Continuing Education, at the same time making their interest known to the director of the Humanities Program.

Immunology

Professor Tedder, *Chair* (353 Jones); Associate Professor Corley, *Director of Graduate Studies* (317 Jones); Professors Buckley, Dawson, Haynes, McClay, Metzgar, Rosse, and Ward; Associate Professor Krangel; Assistant Professors Argon, Doyle, Markert, and Pisetsky; Research Associate Professor Balber; Professor Emeritus Amos

The department offers graduate work leading to the Ph.D. degree. Research programs are available in various aspects of molecular and cellular immunology, including immunochemistry and immunogenetics. The department is also a participating member in the interdisciplinary University Programs in Cell and Molecular Biology and Genetics, and the Medical Scientist Training Program.

The department has excellent facilities for carrying out all aspects of immunologic, cell biologic, and genetic research. A brochure describing the Ph.D. program, prerequisites for admission, and research in the department may be obtained by writing to the Director of Graduate Studies, Department of Immunology, Box 3010, Duke University Medical Center, Durham, NC 27710.

214. Fundamentals of Electron Microscopy. See C-L: Microbiology 214. 3 units. *Miller*

219. Molecular and Cellular Bases of Differentiation. See C-L: Cell Biology 219; also C-L: Biochemistry 219, Microbiology 219, and Pathology 219. 3 units. *Counce and staff*

244. Principles of Immunology. An introduction to the molecular and cellular basis of the immune response. Topics include anatomy of the lymphoid system, lymphocyte biology, antigen-antibody interactions, humoral and cellular effector mechanisms, and

control of immune responses. Prerequisites: Biology 160 and Chemistry 151L or equivalents. C-L: Zoology 244. 3 units. *Kostyu (immunology), McClay, and staff*

246S. Parasitic Diseases. Topics in the physiology and immunology of major human and animal parasites with an emphasis on protozoa and schistosomes. Extensive reading in and discussion of current literature. Basic parasitology developed in introductory readings and lectures. Prerequisites: Microbiology and Immunology 244 or 291, and Biochemistry 227 or equivalent. C-L: Microbiology 246S. 3 units. *Balber*

252. General Virology and Viral Oncology. See C-L: Microbiology 252. 4 units. *Keene and staff*

259. Molecular Biology I: Proteins and Enzymes. Prerequisite: introductory biochemistry or consent of instructor. See C-L: Cell and Molecular Biology 259; also C-L: Biochemistry 259, Cell Biology 259, and Microbiology 259. 3 units. *Richardson and staff*

268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and BCH/CMB/CBI/IMM/MIC 259, or consent of instructor. See C-L: Cell and Molecular Biology 268; also C-L: Biochemistry 268, Cell Biology 268, Microbiology 268, and The University Program in Genetics. 4 units. *Steege and staff*

269. Advanced Cell Biology. Prerequisite: introductory cell biology or consent of instructor. See C-L: Cell and Molecular Biology 269; also C-L: Botany 269, Cell Biology 269, Microbiology 269, and Zoology 269. 3 units. *Nicklas and staff*

291. Comprehensive Immunology. An intensive course in the biology of the immune system and the structure and function of its component parts. Major topics discussed are: properties of antigens; specificity of antibody molecules and their biologic functions; cells and organs of the lymphoid system; structure and function of complement; inflammation and non-specific effector mechanisms; cellular interactions and soluble mediators in lymphocyte activation, replication, and differentiation; regulation of immune responses; neoplasia and the immune system; molecular structure and genetic organization of immunoglobulins, histocompatibility antigens, and T-cell receptor. Required course for all students specializing in immunology. C-L: Microbiology 291. 4 units. *Krangel and staff*

304. Molecular Membrane Biology. An advanced seminar course covering selected aspects of current research on biogenesis and dynamics of various cellular membranes. Emphasis will be on the cell biology of the immune system. Discussion topics will represent the following areas: biosynthesis of membrane proteins; intracellular transport vesicles; endocytosis; signal transduction across the plasma membrane; intracellular organelles and protein sorting; cell interactions in differentiation. Prerequisite: Microbiology 269 or consent of instructor. C-L: Microbiology 304. 2 units. *Argon*

310. Molecular Development. See C-L: Microbiology 310. 2 units. *Linney*

330. Medical Immunology. A brief review of basic concepts in immunology followed by in-depth discussions of the role of immune mechanisms in the pathogenesis and treatment of human diseases. Principle emphasis on immune deficiency diseases, hypersensitivity, alloimmunity, transplantation, infectious diseases, autoimmunity, tumor immunology, and immunohematology. 5 units. *Ward and staff*

332. Immunology Seminar. Research topics in immunology with seminars presented by students, faculty, and outside speakers. Required course for all students specializing in immunology. 1 unit. *Staff*

335-336. Current Topics in Immunology. Focus on current immunology research, emphasizing emerging research areas and new directions in established areas. Students present recent papers in selected subjects. Credit/no credit. 2 units. *Corley and staff*

The Duke–University of North Carolina Program in Latin American Studies

Professor William Ascher, *Director*, (026 Old Chemistry Building)

The Duke-UNC Program in Latin American Studies cooperates with the Council on Latin American Studies to oversee and coordinate graduate education in Latin American studies at Duke. Graduate students in Arts and Sciences as well as professional school students may concentrate their studies on Latin America. In addition to fulfilling the requirements of their departments, students of Latin American studies may undertake special courses of interdisciplinary study, or those offered by other departments, to broaden their knowledge of the region. (For additional information about the council and the graduate certificate in Latin American Studies, see the section on "Special and Cooperative Programs" in this bulletin.)

The interdisciplinary focus of the graduate program is enhanced by the numerous activities of the Duke-UNC program, which offers graduate students at Duke an array of intellectually challenging opportunities to broaden their disciplinary training. The single most important initiative of the Duke-UNC program is the sponsorship of interdisciplinary working groups that bring together faculty and graduate students from both campuses to conduct research and training in areas of central concern to Latin American studies. The objective is to move beyond the seminar format that dominates graduate education in the social sciences and humanities, and to focus instead upon training graduate students in a manner similar to the direct research collaboration that typically characterizes training in the natural sciences. The groups focus on topics such as political economy, health and the environment, culture, gender issues, religious change and labor issues in Latin America. The program also sponsors a Graduate Student Colloquium designed to encourage interaction between the two graduate student bodies and administers a competition for graduate student travel grants each spring. These awards provide Duke students with the opportunity to deepen their disciplinary interests in the region through relatively brief periods of research in Latin America. In 1991 the Duke-UNC program was designated a National Resource Center for Latin American Studies by the U.S. Department of Education. This honor is accompanied by funding for a number of new activities as well as Foreign Language and Area Studies (FLAS) Fellowships for graduate students.

Further information on the activities of the program and special opportunities for graduate students may be obtained from the Duke Program Coordinator, Duke-UNC Program in Latin American Studies, 026 Old Chemistry Building, Box 90254, Duke University, Durham, NC 27708-0254.

200S. Seminar in Latin American Studies. Interdisciplinary study of geographical, historical, economic, governmental, political, and cultural aspects of modern Latin America and the current issues facing the region. Specific topics will vary from year to year. For juniors, seniors, and graduate students. 3 units. *Staff*

Courses with Latin American Content Offered by Departments

Art 257S. Topics in Pre-Columbian Art and Culture. *Reents-Budet*

Economics 219S. Economic Problems of Underdeveloped Areas. *Kelley or Krueger*

Education 205. Higher Education in Latin America. *DiBona*

Environment 217. Tropical Ecology. *Terborgh*

Environment 221. Soil Resources. *Richter*

Environment 277. Conservation and Sustainable Development I: Concepts and Methods. *Staff*

Environment 278. Conservation and Sustainable Development II: Integrated Problem-Solving.

Staff

Environment 285. Land Use Principles and Policy. *Healy*

History 207S. Geographical Perspectives in History I: Western Europe and the Americas. *Wigen*

History 230. Populism in Latin America. *James*

- History 231S. Readings in Latin American Colonial History. *TePaske*
 History 233. Slave Resistance and Social Control in New World Societies. *Gaspar*
 History 257. Comparative Latin American Labor. *French*
 History 265S. Problems in Modern Latin American History. *Staff*
 History 351. Colloquium on Latin American Colonial History. *TePaske*
 Literature 292. Topics in Non-Western Literature and Culture. *Mudimbe or Pérez-Firmat*
 Literature 302. Seminar in Emergent Literatures. *Staff*
 Political Science 253S. Comparative Government and the Study of Latin America. *Archer*
 Political Science 381. Research Seminar in Latin American Government and Politics. *Staff*
 Portuguese 200S. Seminar in Luso-Brazilian Literature: Africa and the African Diaspora in Portuguese. *Anderson*
 Public Policy Studies 264S. Natural Resources and Sustainable Development. *Miranda*
 Public Policy Studies 267S. Policy-Making in International Organizations. *Ascher*
 Public Policy Studies 284S. Public Policy Process in Developing Countries. *Ascher*
 Public Policy Studies 286S. Economic Policy-Making in Developing Countries. *Conrad, Gillis, or Ramachandran*
 Public Policy Studies 325S, 326S. Program in International Development Policy Sector Seminar. *Staff*
 Public Policy Studies 327, 328. Program in International Development Policy Issues Seminar. *Staff*
 Religion 263. Third World Theology. *Staff*
 Sociology 222D. Proseminar in Comparative Historical Sociology: Theories of Change in Third World. *Staff*
 Spanish 245. Modern Spanish-American Poetry. *Staff*
 Spanish 248. Studies in Spanish-American Literature. *Staff*
 Spanish 341. Colonial Prose of Spanish America. *Ross*
 Spanish 342. Colonial Poetry and Theater of Spanish America. *Ross*
 Spanish 346. Modern Spanish-American Fiction. *Pérez-Firmat*
 Spanish 391, 392. Hispanic Seminar. *Staff*

The Master of Arts in Liberal Studies Program

Diane Sasson, Ph.D., *Director*

This interdisciplinary program allows individuals with a variety of professional and personal educational interests the flexibility to pursue their goals across traditional disciplinary boundaries. The program is managed by an interdepartmental committee which admits students, selects courses, and determines policy. Students study primarily on a part-time basis and choose from an array of interdisciplinary courses developed specifically for this program. In addition to the special liberal studies courses, students may select courses from other departments in the Graduate School.

The MALS program consists of nine courses and a final project. These courses are offered during three academic terms (fall, spring, and summer) and may be taken either on a full-time or part-time basis. For more information on specific courses and other program requirements, a separate bulletin on the Master of Arts in Liberal Studies may be requested from the program director (Box 90095, Duke University, Durham, North Carolina 27708).

The Program in Literature

Professor Jameson, *Chair* (Graduate Program in Literature and French); Professor Moi, *Director of Graduate Studies* (Graduate Program in Literature and French); Professors DeNeef (English), Fish (English and law), Lentricchia (Graduate Program in Literature and English), Mignolo (Romance studies and Graduate Program in Literature), A. Mudimbe (Graduate Program in Literature, French, and cultural anthropology), A. Patterson (English and Graduate Program in Literature), Pérez Firmat (Spanish and Graduate Program in Literature), Radway (Graduate Program in Literature), Rolleston (Germanic languages and literature), Schor (French and Graduate Program in Literature), B. H. Smith (Graduate Program in Literature and English), Stewart (French), Thomas (French and Graduate Program in Literature), and Tompkins (English); Associate Professors Gaines (Graduate Program in Literature and English), Kaplan (French and Graduate Program in Literature), and Surin (Graduate Program in Literature and

religion); Research Professor Dorfman (Graduate Program in Literature and Latin American studies)

The interdepartmental program leading to a Ph.D. in literature offers to qualified students the opportunity to develop individual courses of study with a strong emphasis on interdisciplinary work, literary theory, and cultural studies, while at the same time building strength in one or more of the national literatures. The program offers both introductory courses (the 250 series) and more specialized seminars (the 280 series), as well as tutorials (300) in specific research projects or problems.

For tutorials, advising, and dissertation supervision the program draws also on the expertise of other faculty such as Professor C. Davidson (English), Associate Professor Wharton (art); Professor Newton and Associate Professor Burian (classical studies); Professors L. Patterson, Ryals, Sedgwick, and Torgovnick (English); Professor Tetel and Associate Professor Orr (French); Professor Borchardt (German); and Professor Lahusen (Slavic). Students entering the program must present evidence of ability to read one language other than English, and must acquire reading competence in a second language before taking their preliminary examinations.

More information on the program and a full descriptive brochure is available from Professor Moi, Director of Graduate Studies, Art Museum 104, Duke University, Durham, North Carolina 27708-0670.

211. Theory and Practice of Literary Translation. Linguistic foundations and historical role of translation. Practical exercises and translation assignments. Prerequisites: working knowledge of a foreign language and consent of instructor. 3 units. *Burian*

251. History of Criticism. A historical survey of critical and philosophical concepts affecting the definition and evaluation of literature from Plato through the nineteenth century. 3 units. *DeNeef, Lentricchia, or Pérez Firmat*

252. Criticism and Literary Theory in the Twentieth Century. Introduction to critical movements, philosophies, and strategies forming contemporary theories of literature: deconstruction, feminism, formalism, Marxism, New Criticism, phenomenology, psychoanalysis, structuralism. May be repeated for credit according to change of content or instructor. 3 units. *Jameson or Rolleston, with guest lecturers*

253. Philology, Linguistics, and the Roots of Literature. A survey of the various ways in which language and literature interact, with an introduction to philology and historical linguistics. 3 units. *Andrews (Slavic) or Thomas*

254. Introduction to Feminism. Major trends and tendencies of feminist theory and its history. Perspectives are both international as well as Third World and interdisciplinary. Various feminist methodologies as well as crucial polemics. 3 units. *Moi, Radway, or Schor*

(The 280-290 series implies prior knowledge of literary theory, past and present; these courses are open to graduate students and qualified seniors only.)

280. Semiotics for Literature. See C-L: French 223. 3 units. *Thomas*

281. Paradigms of Modern Thought. Specialized study of the work of individual thinkers who have modified our conceptions of human reality and social and cultural history, with special emphasis on the form and linguistic structures of their texts considered as "language experiments." Topics will vary from year to year, including: Marx and Freud; J.-P. Sartre; Walter Benjamin; etc. 3 units. *Jameson, Moi, Mudimbe, or Surin*

282. Contemporary Literary Theory. Specialized studies in literary theory from Saussurean linguistics to the present day (e.g., deconstruction, feminism, new histori-

cism, neopragmatism, reception theory). 3 units. *Fish, Jameson, Lentricchia, Patterson, or Tompkins*

283. Modernism. Aspects of the "modern," sometimes with emphasis on the formal analysis of specific literary and nonliterary texts (Joyce, Kafka, Mahler, Eisenstein); sometimes with a focus on theories of modernism (Adorno), or on the modernism/postmodernism debate, or on the sociological and technological dimensions of the modern in its relations to modernization, etc. 3 units. *Jameson or Lentricchia*

284. The Intellectual as Writer. History and theory of the literary role of the intellectual in society (e.g., in Augustan Rome, the late middle ages, the Renaissance, America, Latin America). 3 units. *Jameson, Lentricchia, Moi, Mudimbe, or Patterson*

285. Literature and Ideology. The theoretical problem of the relationship between literature and ideology, explored through the cultural history of genres, major writers, or aesthetic movements. 3 units. *Jameson, Lentricchia, Mudimbe, or Patterson*

286. Topics in Legal Theory. A consideration of those points at which literary and legal theory intersect (e.g., matters of intention, the sources of authority, the emergence of professional obligation). 3 units. *Fish*

287. Problems in Narrative Analysis. An introduction to contemporary theories and methods of narrative analysis (Greimas, Barthes, Hayden White, etc.), with emphasis on a specific area (e.g., historiography, film, sub-genres of the novel, myth, cognitive discourse). 3 units. *Jameson, Mudimbe, or Radway*

288. Basic Issues in the History of Literary Theory. Issues include attempts to define literature, divergent views of its social functions and psychological effects, and contemporary controversies regarding literary meaning and interpretation. Readings range from classic texts in philosophy of art to contemporary essays in critical theory. 3 units. *B. H. Smith or Stewart*

289. Topics in Feminist Theory. 3 units. *Moi, Radway, Schor, or Tompkins*

290. Topics in Psychoanalytic Criticism. 3 units. *Moi*

291. Topics in Popular Culture and the Media. 3 units. *Radway, Tompkins, or Willis*

292. Topics in Non-Western Literature and Culture. 3 units. *Mudimbe or Pérez Firmat*

293. Seminars in Literature and History. Relationship of literary texts to varieties of historical experience such as wars, periods of revolutionary upheaval, periods of intense economic growth, "times of troubles," or stagnation. Literary texts and historical content posed in such formal ways as the theoretical problem of the relationship between literary expression and form and a range of historical forces and phenomena. 3 units. *Jameson, Kaplan, Orr, A. Patterson, or Schor*

294. Theories of the Image. Different methodological approaches to theories of the image (film, photography, painting, etc.), readings on a current issue or concept within the field of the image. Examples of approaches and topics are feminism, psychoanalysis, postmodernism, technology, spectatorship, national identity, authorship, genre, economics, and the ontology of sound. 3 units. *C. Davidson, Gaines, or Jameson*

295. Representation in a Global Perspective. Problems of representation approached in ways that cross and question the conventional boundaries between First and Third World. Interdisciplinary format open to exploration of historical, philosophical, archeological, and anthropological texts as well as literary and visual forms of representation. 3 units. *Dorfman, Jameson, or Mignolo*

300. Problems in the Theory of Value and Judgment. An advanced seminar dealing with classic problems relating to the concept of value and evaluative behavior (e.g., standards, judgments, canon-formation, taste), as illuminated by contemporary work in critical theory, anthropology, economics, sociology, etc. C-L: English 386 and Philosophy 300. 3 units. *B. H. Smith*

301. Language and Theory in the Twentieth Century. A seminar examining some of the most significant analyses, controversies, and achievements of the various disciplinary approaches to language during the past century and their implications for cultural study. Topics include the question of linguistics as a science, the muddle of meaning and interpretation, approaches to communication as social interaction, the Chomskian episode, and poststructural/postanalytic conceptions and contributions. 3 units. *Fish, B. H. Smith, and Tetel*

302. Seminar in Emergent Literatures. An advanced seminar in the literature of Third World or nonwestern countries. Specific topics vary from year to year. 3 units. *Staff*

303. Topics in Criticism and Aesthetics. Selected readings in traditional and contemporary criticism, philosophical aesthetics, and literary theory. 3 units. *Visiting faculty or staff*

391. Tutorial in Special Topics. Directed research and writing in areas unrepresented by regular course offerings. Consent of instructor required. 3 units. *Staff*

399. Special Readings. Consent of instructor required. 3 units. *Staff*

The University Program in Marine Sciences

Professor Ramus (botany and environment), *Director*; Associate Professor Rittschof (zoology and environment), *Director of Graduate Studies*; Professors Barber (botany, environment, geology, and zoology), C. Bonaventura (cell biology and environment), J. Bonaventura (cell biology and environment), Forward (zoology and environment), Gutknecht (cell biology and environment), Johnson (geology and environment), Pilkey* (geology), Searles† (botany), and Sutherland (zoology and environment); Assistant Professors Howd (environment and geology) and Lozier (environment, geology, and mechanical engineering and materials science); Professor Emeritus Bookhout (zoology); Assistant Medical Research Professor Van Beneden (cell biology and environment)

Graduate students from any and all academic disciplines are encouraged to take training at the Marine Laboratory. The program operates year-round, providing course work in the ocean sciences, an active seminar program, and facilities supporting dissertation research. Resident graduate students represent the Departments of Botany, Cell Biology, Environment, Geology, and Zoology. Ordinarily, dissertation advisors are resident as well, although this need not be the case. The Marine Laboratory has available several graduate student instructional assistantships and fellowships during the academic year, including summer. In addition, tuition credits obtained from fellowship support may be applied to courses given both at the Marine Laboratory and the Durham campus.

Persons interested in graduate work in the marine sciences should apply through one of the appropriate departments (botany, cell biology, environment, geology, or

*Spring only.

†Summer only.

zoology). The application form for enrollment in a graduate degree program may be obtained from the Graduate School.

Graduate students planning to enroll in academic course work at the Marine Laboratory during the fall or spring semester should notify the Admissions Office of the Marine Laboratory of such intent at the time of preregistration for the respective semester and must register as normally prescribed. Students planning to enroll in academic course work or graded graduate research at the Marine Laboratory during the summer must submit the appropriate application form to the Admissions Office, Duke University, School of the Environment, Marine Laboratory, Beaufort, North Carolina 28516-9721. The application form for enrollment in summer courses is found in the publication *Marine Laboratory 1993*. Students registering for graded research in the fall, spring, or summer should do so under the appropriate departmental numbers.

The following courses are offered at Beaufort. See the publication *Marine Laboratory 1993* for the current schedule of courses.

FALL, SPRING, OR SUMMER PROGRAM AT BEAUFORT

For Juniors, Seniors, and Graduates

Botany 217L. Biology of Marine Macrophytes. Physiology and ecology of seaweeds, seagrasses, marshgrasses, and mangroves. Biological flux of carbon and nutrients in coastal seas. Ecological consequences of photosynthetic adaptations. Prerequisites: introductory biology and chemistry. 4 units. *Ramus*

Botany 218L. Barrier Island Ecology. An integration of barrier island plant and animal ecology within the context of geomorphological change and human disturbance. Topics include: barrier island formation and migration, plant and animal adaptations, species interactions, dune succession, maritime forests, salt marshes, sea level rise, conservation policy, and restoration ecology. Field trips to many of the major North Carolina barrier islands. Emphasis on field observation and independent research. Given at Beaufort. Prerequisite: introductory biology; suggested: course in botany or ecology. C-L: Environment 218L. 6 units. *Evans, Peterson, and Wells (visiting summer faculty)*

Botany 219L. Benthic Marine Algae. Morphology, reproduction, life histories, systematics, and natural history of seaweeds. Lectures, laboratories, and fieldwork in ocean and estuaries. Prerequisite: introductory biology; plant diversity recommended. C-L: Environment 296L. 4 units. *Searles*

Botany 359, 360. Research. Individual investigation in the various fields of botany. Credit to be arranged. *All members of the Graduate School staff*

Cell Biology 210. Individual Study. Directed reading and research in cell biology/physiology. Prerequisite: consent of director of graduate studies. Credit to be arranged. *Staff*

Cell Biology 235, 235L. Advanced Research Training in Marine Molecular Biology and Biotechnology. Modern molecular biology is taught in lectures and laboratory exercises using fish, molluscs, algae, and marine forms. Topics and techniques include DNA, RNA, and protein assays; isolation; genomic library screening; and bacteriological and cell culture techniques. Given at Beaufort. 4 units; 6 units with laboratory. *Van Beneden*

Cell Biology 270S. Molecular and Cellular Adaptations of Marine Organisms. Marine organisms meet the challenge of living in a hostile and ever-changing environment by numerous adaptive mechanisms. This seminar focuses on the underlying cellular and molecular processes. Topics explored in regard to adaptive processes in marine organisms include changes in metabolism, respiration, and vision. The impact of environmental pollutants and human health significance will also be addressed. 2 units. *C. Bonaventura*

Environment 222S. Coastal Processes. Waves and currents in the nearshore zone and their role in beach evolution. Linear wave theory and models for beach evolution. Other topics include nearshore currents, tides, estuarine circulation, and field techniques for measurement of nearshore morphology and fluid motions. Term paper required. Prerequisite: introductory calculus. C-L: Geology 201S. 2 units. *Howd*

Environment 225L. Coastal Ecotoxicology and Pollution. Principles of transport, fates, food-web dynamics and biological effects of pollutants in the marine environment. Laboratory to stress standard techniques for assessing pollutant levels and effects. Prerequisites: introductory chemistry and biology. (Given at Beaufort.) 4 units. *Staff*

Environment 226. Cetacean Biology. Taxonomy, life cycles, social organization, behavior communication, and conservation of whales and dolphins. Social organization and acoustic communication

will be studied in the local bottlenose dolphin population. (Given at Beaufort.) Suggested prerequisite: introductory biology. 2 units. *Forward and staff*

Environment 243. Environmental Biochemistry. Introduction to the (macro)molecules of life and fundamental metabolic pathways. Topics are presented in the context of environmental perturbations. Fundamental aspects of energetics, proteins, enzymes, carbohydrates, lipids and nucleic acids. Emphasis on mechanisms of adaptation, molecular controls, and responses to toxicants. Prerequisite: organic chemistry. C-L: Environment 243. 3 units. *C. Bonaventura and Brouwer*

Environment 244. Cellular and Molecular Research Techniques. Introduction to the use of electrophoresis, chromatography, enzymology, equilibrium assays, rapid reaction kinetics, microscopy, molecular graphics and various modes of spectroscopy in analyzing molecules and tissues of organisms collected from polluted and pristine environments. The applicability of techniques of modern molecular biology are discussed in relation to other research techniques used to examine fundamental molecular mechanisms and the adverse effects of pollutants on natural processes. Prerequisite: organic chemistry. C-L: Environment 244. 3 units. *C. Bonaventura and Brouwer*

Environment 252L. Techniques in Environmental Data Analysis. Introduction to techniques commonly used by environmental scientists for the study of spatial and/or temporal series of data. Topics will include regression, Fourier analysis, spectral and cross-spectral analysis and empirical orthogonal functions. Emphasis on developing a hands-on understanding of the methods and correct interpretation of results. Term project required. Prerequisite: introductory calculus. C-L: Geology 222L. 4 units. *Howd*

Environment 290. Physical Oceanography. Introduction to the dynamic principles of ocean circulation with an emphasis on large temporal and spatial scales of motion. Topics to be covered include wind-driven and density-driven flow, western boundary intensification, mid-ocean, shelf and tropical circulations. Prerequisite: laboratory calculus. C-L: Geology 203 and Mechanical Engineering 290. 3 units. *Lozier*

Environment 292L. Biological Oceanography. Physical, chemical, and biological processes of the oceans, emphasizing special adaptation for life in the sea and factors controlling distribution and abundance of organisms. Laboratory emphasis. prerequisite: introductory biology. Variable credit. *Ramus or staff*

Environmental 294L. Marine Communities. Dynamics of marine communities in the context of current ecological theory. Life history strategies, competition, predation, diversity, and stability; detailed considerations of benthic and pelagic communities. Prerequisites: introductory biology and mathematics. 4 units. *Gerhart*

Environment 295L. Marine Invertebrate Zoology. Structure, function, and development of invertebrates collected from estuarine and marine habitats. Not open to students who have taken Biology or Zoology 274L. Prerequisite: introductory biology. Variable credit. *Kirby-Smith*

Environment 299. Independent Studies and Projects. Directed readings or research at the graduate level to meet the needs of individual students. Consent of instructor required. Units to be arranged. *Staff*

Geology 205S. Geological Oceanography. The geology of ocean basins, including origin, bottom physiography, sediment distribution, and sedimentary processes. Not open to students who have taken Geology 206S. C-L: Environment 291S. 3 units. *Johnson*

Geology 209. Climatic Change. Record of changing climate on Earth, as determined from the analysis of deep sea sediments, ice-cores, lake sediments, and tree rings. 4 units. *Johnson*

Geology 371, 372. Advanced Topics in Geology. To meet the individual needs of graduate students for independent study in various environmental sedimentary fields. 1 to 3 units. *Staff*

Zoology 203L. Marine Ecology. Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent research projects. Topics include characteristics of marine habitats, adaptation to environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. Prerequisites: none; suggested—introductory ecology, invertebrate zoology, or marine botany. C-L: Environment 219L. 6 units. *Gerhart*

Zoology 213L. Behavioral Ecology. How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. Prerequisite: introductory biology. 4 units. *Rubenstein (visiting summer faculty)*

Zoology 223. Analysis of Ocean Ecosystems. Examination of the ecosystem concept considering its utility, utility, and heuristic value. Examination of ocean systems in the context of Odum's ecosystem concept. Structure and function of the earth's major ecosystems. Term paper required. Prerequisites: one year of biology and chemistry, or consent of instructor. C-L: Environment 293. 3 units. *Barber*

Zoology 250L. Physiology of Marine Animals. Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. Prerequisites: introductory biology and chemistry. 4 units (fall); 6 units (summer). *Forward*

Zoology 255L. Biochemistry of Marine Animals. Functional, structural, and evolutionary relationships of biochemical processes of importance to marine organisms. Prerequisites: introductory biology and inorganic chemistry. 4 units. *Rittschof*

Zoology 274L. Biology of Marine Invertebrates. Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips included. Not open to students who have taken Zoology 76L or 176L. Prerequisite: introductory biology. C-L: Environment 297L. 6 units. *Dimock (visiting summer faculty)*

Zoology 353, 354. Research. To be carried on under the direction of the appropriate staff members. Hours and credit to be arranged. *Staff*

Zoology 360, 361. Tutorials. An approved academic exercise, such as writing an essay or learning a research skill, carried out under the direction of the appropriate staff members. Hours and credit to be arranged. *Staff*

Seminar. Special topics in the ocean sciences. Exploration at the advanced level of current research in the ocean sciences. Subject dependent on faculty and student interests. Botany 295S, 296S; or Zoology 295S, 296S. 2 units. *Staff*

COURSES CURRENTLY UNSCHEDULED

Biochemistry 245L. Macromolecules, Ecology, and Evolution

Biochemistry 276. Comparative and Evolutionary Biochemistry

Biology 263L. Tropical Seaweeds

Mathematics

Professor Schaeffer, *Chair* (132-B Physics); Professor Bryant, *Director of Graduate Studies* (128-A Physics); Professors Allard, Beale, Hain, Lawler, Morrison, Pardon, Reed, Rose, Stern, Venakides, Warner, and Weisfeld; Associate Professors Burdick, Hodel, Kitchen, Kraines, Moore, Saper, Schoen, Scoville, Smith, and Trangenstein; Assistant Professors Layton, Yang, and Zheng; Adjunct Professor Chandra

Graduate work in the Department of Mathematics is offered leading to the A.M. and Ph.D. degrees. Admission to these programs is based on the applicant's undergraduate academic record, level of preparation for graduate study, the Graduate Record Examination, and letters of recommendation.

All A.M. and Ph.D. candidates are required to pass a qualifying examination after completing their first year of graduate study. The A.M. degree with a major in mathematics is awarded upon completion of 30 units of graded course work and passing the qualifying examination. A thesis may be substituted for 6 units of course work only under special circumstances.

Soon after the student who is pursuing a Ph.D. degree passes the qualifying examination, the director of graduate studies appoints a committee of two graduate faculty members who determine the conditions to be met by the student before he or she takes the preliminary examination. Normally, this committee forms the nucleus of the student's advisory committee. The conditions may include a reading knowledge of one or more foreign languages appropriate to the student's intended area of specialization, an appropriate level of computer programming proficiency, or specific course work.

Candidacy for the Ph.D. is established by passing an oral preliminary examination. The preliminary examination is normally taken during the third year. The preliminary examination is conducted by a committee selected by the rules of the Graduate School and the department. The examination can, at the student's option, consist of questions based either on the student's course work at Duke or on the specific area of research plus a minor subject selected by the student.

After admission to candidacy, the Ph.D. degree is awarded on the basis of the student's scholarly ability as demonstrated by the dissertation and its defense. The dissertation is the most important requirement in the award of the Ph.D. degree.

For Seniors and Graduates

200. Introduction to Algebraic Structures I. Laws of composition, groups, rings; isomorphism theorems; axiomatic treatment of natural numbers; polynomial rings; division and Euclidean algorithms. Not open to students who have had Mathematics 121. Prerequisite: Mathematics 104 or equivalent. 3 units. *Staff*

201. Introduction to Algebraic Structures II. Vector spaces, matrices and linear transformations, fields, extensions of fields, construction of real numbers. Prerequisites: Mathematics 200, or Mathematics 121 and consent of instructor. 3 units. *Staff*

203. Basic Analysis I. Topology of R^n , continuous functions, uniform convergence, compactness, infinite series, theory of differentiation, and integration. Not open to students who have had Mathematics 139. Prerequisite: Mathematics 104. 3 units. *Staff*

204. Basic Analysis II. Inverse and implicit function theorems, differential forms, integrals on surfaces, Stokes' theorem. Not open to students who have had Mathematics 140. Prerequisites: Mathematics 203, or Mathematics 139 and consent of instructor. 3 units. *Staff*

205. Topology. Elementary topology, surfaces, covering spaces, Euler characteristic, fundamental group, homology theory, exact sequences. Prerequisite: Mathematics 104. 3 units. *Staff*

206. Differential Geometry. Geometry of curves and surfaces, the Serret-Frenet frame of a space curve, the Gauss curvature, Cadazzi-Mainardi equations, the Gauss-Bonnet formula. Prerequisite: Mathematics 104. 3 units. *Staff*

221. Numerical Analysis. Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. See C-L: Computer Science 221; also C-L: Statistics 273. 3 units. *Gardner, Greenside, Lanzkron, or Rose*

222. Numerical Differential Equations. Prerequisite: Computer Science 221. See C-L: Computer Science 222. 3 units. *Gardner, Greenside, Lanzkron, or Rose*

223. Numerical Linear Algebra. See C-L: Computer Science 223. 3 units. *Lanzkron or Rose*

230. Mathematical Methods in Physics and Engineering I. Heat and wave equations, initial and boundary value problems, Fourier series, Fourier transforms, potential theory. Not open to students who have had Mathematics 114. Prerequisites: Mathematics 103 and 104 or equivalents. 3 units. *Staff*

231. Mathematical Methods in Physics and Engineering II. Green's functions, partial differential equations in several space dimensions. Complex variables, analytic functions, Cauchy's theorem, residues, contour integrals. Other topics may include method of characteristics, perturbation theory, calculus of variations, or stability of equilibria. Prerequisite: Mathematics 114 or 230. 3 units. *Staff*

233. Asymptotic and Perturbation Methods. Asymptotic solution of linear and nonlinear ordinary and partial differential equations. Asymptotic evaluation of integrals. Singular perturbation. Boundary layer theory. Multiple scale analysis. Prerequisite: Mathematics 114 or equivalent. 3 units. *Staff*

238. Topics in Applied Mathematics. Conceptual basis of applied mathematics, combinatorics, graph theory, game theory, mathematical programming, or numerical solution of ordinary and partial differential equations. Prerequisites: Mathematics 103 and 104 or equivalents. 3 units. *Staff*

240. Applied Stochastic Processes. Applications of probability theory and stochastic processes to economics and environmental science. Markoff chains, optional stopping, queuing theory, decision theory, birth and death processes, and the Monte Carlo method. Prerequisite: Mathematics 135 or equivalent. C-L: Statistics 253. 3 units. *Staff*

241. Linear Models. Prerequisites: Mathematics 104 and Statistics 113 or 210. See C-L: Statistics 244. 3 units. *Staff*

242. Introduction to Multivariate Statistics. Prerequisite: Statistics 244 or equivalent. See C-L: Statistics 245. 3 units. *Burdick*

245. Functional Analysis for Scientific Computing. See C-L: Computer Science 245. 3 units. *Rose*

251. Set Theory I. Zermelo-Fraenkel axioms, ordinals and cardinals, models of set theory, constructible sets. Prerequisite: Mathematics 187 or 200 or equivalent. 3 units. *Staff*

252. Set Theory II. Forcing, large cardinals, determinateness, and other advanced topics. Prerequisite: Mathematics 251. 3 units. *Staff*

253. Recursion Theory. Register and Turing machines; recursive functions and sets; enumeration theorems; recursively enumerable sets; arithmetical and analytic hierarchies; degrees; unsolvable problems; complexity theory. Prerequisite: Mathematics 187 or Mathematics 200 or equivalent. 3 units. *Staff*

258, 259. Topics in Logic. Model theory, recursion theory, set theory, or other fields of logic. Prerequisite: Mathematics 250 or equivalent. 3 units each. *Staff*

260. Groups, Rings, and Fields. Groups including nilpotent and solvable groups, p-groups and Sylow theorems; rings and modules including classification of modules over a PID and applications to linear algebra; fields including extensions and Galois theory. Prerequisite: Mathematics 201 or equivalent. 3 units. *Staff*

261. Commutative Algebra. Extension and contraction of ideals, modules of fractions, primary decomposition, integral dependence, chain conditions, affine algebraic varieties, Dedekind domains, completions. Prerequisite: Mathematics 260 or equivalent. 3 units. *Staff*

268. Topics in Algebra. Algebraic number theory, algebraic K-theory, homological algebra, or topological algebra. Prerequisite: Mathematics 260. 3 units. *Staff*

271. Algebraic Topology. Fundamental group and covering spaces, homology groups of cell complexes, classification of compact surfaces, the cohomology ring and Poincaré duality for manifolds. Prerequisites: Mathematics 171S and 200 or equivalents. 3 units. *Staff*

273. Algebraic Geometry. Local theory: affine varieties, algebraic and topological theory of singularities. Global theory over the complex numbers: Riemann surfaces, Jacobians, Kähler manifolds, Hodge theory, theorems of Lefschetz and Kodaira. Prerequisite: Mathematics 261 or equivalent. 3 units. *Staff*

275. Differential Geometry. Differentiable manifolds, fiber bundles, connections, curvature, characteristic classes, Riemannian geometry including submanifolds and

variations of the length integral, complex manifolds, homogeneous spaces. Prerequisites: Mathematics 204 and 260 or equivalents. 3 units. *Staff*

276. Topics in Differential Geometry. Lie groups and related topics, Hodge theory, index theory, minimal surfaces, Yang-Mills fields, exterior differential systems, several complex variables. Prerequisite: Mathematics 275 or consent of instructor. 3 units. *Staff*

277. Topics in Algebraic Geometry. Projective varieties and the theory of extremal rays, classification of surfaces and higher-dimensional varieties, variation of Hodge structure and moduli problems, schemes and arithmetic varieties, or other advanced topics. Prerequisite: Mathematics 273 or consent of instructor. 3 units. *Staff*

278, 279. Topics in Topology. Point set, algebraic, geometric, or differential topology. Consent of instructor required. 3 units each. *Staff*

281. Real Analysis I. Measures; Lebesgue integral; L_p spaces; Daniell integral, differentiation theory, product measures. Prerequisite: Mathematics 204 or equivalent. 3 units. *Staff*

282. Real Analysis II. Metric spaces, fixed point theorems, Baire category theorem, Banach spaces, fundamental theorems of functional analysis, Fourier transform. Prerequisite: Mathematics 281 or equivalent. 3 units. *Staff*

284. Topics in Functional Analysis. Advanced spectral analysis, operator algebras, nonlinear functional analysis, or structure theory of Banach spaces. Prerequisite: Mathematics 282 or equivalent. 3 units. *Staff*

285. Complex Analysis. Complex calculus, conformal mapping, Riemann mapping theorem, Riemann surfaces. Prerequisite: Mathematics 204 or equivalent. 3 units. *Staff*

286. Topics in Complex Analysis. Geometric function theory, function algebras, several complex variables, uniformization, or analytic number theory. Prerequisite: Mathematics 285 or equivalent. 3 units. *Staff*

290. Probability. Random variables, independence, expectations, laws of large numbers, central limit theorem, Markoff chains. Prerequisite: Mathematics 281 or equivalent. C-L: Statistics 207. 3 units. *Staff*

293. Topics in Probability Theory. Brownian motion, diffusion processes, random walks, and applications to differential equations and mathematical physics. Prerequisite: Mathematics 290 or consent of instructor. C-L: Statistics 297. 3 units. *Staff*

295. Fourier Analysis and Distribution Theory. Tempered distributions, Fourier transforms, classical inequalities, and oscillatory integrals. Prerequisites: Mathematics 204 and 285 or equivalents. 3 units. *Staff*

296. Ordinary Differential Equations. Existence and uniqueness theorems for nonlinear systems, well-posedness, two-point boundary value problems, phase plane diagrams, stability, dynamical systems, and strange attractors. Prerequisites: Mathematics 104, 111 or 131, and 203 or 139. 3 units. *Staff*

297. Partial Differential Equations I. Fundamental solutions of linear partial differential equations, hyperbolic equations, characteristics, Cauchy-Kowalevski theorem, propagation of singularities. Prerequisite: Mathematics 204 or equivalent. 3 units. *Staff*

298. Partial Differential Equations II. Elliptic boundary value problems, regularity theorems, the diffusion equation, and nonlinear equations. Prerequisite: Mathematics 297 or equivalent. 3 units. *Staff*

299. Topics in Partial Differential Equations. Hyperbolic conservation laws, pseudo-differential operators, variational inequalities, theoretical continuum mechanics. Prerequisite: Mathematics 298 or equivalent. 3 units. *Staff*

378-379. Current Research in Topology. 6 units. *Staff*

388, 389. Current Research in Analysis. 3 units each. *Staff*

COURSES CURRENTLY UNSCHEDULED

234. Mathematics for Quantum Mechanics

235. Topics in Mathematical Physics

239. Topics in Applied Mathematics

250. Introductory Mathematical Logic

269. Topics in Algebra

280. Differential Analysis

283. Linear Operators

288, 289. Topics in Analysis

294. Topics in Probability Theory

358-359. Current Research in Logic

368-369. Current Research in Algebra

387. Current Research in Mathematical Physics

Program in Medieval and Renaissance Studies

Professor Witt, *Chair*; Professor Mahoney, *Director of Graduate Studies* (211-J West Duke)

The graduate Program in Medieval and Renaissance Studies is an interdisciplinary program administered by the Duke University Center for Medieval and Renaissance Studies. In consultation with the director of graduate studies, students in the program select courses in art, history, music, philosophy, religion, language, and literature (classical studies, English, German, and Romance languages). For descriptions of the individual courses see the listings under the specified department.

200S. Seminar in Medieval and Renaissance Studies. Topics in the historiography and interpretation of medieval and Renaissance culture. Topics will vary from year to year. 3 units. *Staff*

DEPARTMENT OF ART AND ART HISTORY

216. The Art of the Counter-Reformation. *Rice*

229. The History of Prints and Printmaking. *Rice*

231. Art of the Early Middle Ages. *Wharton*

232. Art of the Late Middle Ages. *Wharton*

233S. Topics in Early Christian and Byzantine Art. *Wharton*

234. Medieval Architecture. *Staff*

235. Gothic Cathedrals. *Staff*

236S. Topics in Romanesque and Gothic Art and Architecture. *Staff*

239. Aspects of Medieval Culture. *Wharton*

240. Giotto and the Origins of the Renaissance. *Staff*

241. Fifteenth-Century Italian Art. *Rice*

242. Sixteenth-Century Italian Art. *Rice*

243S. Topics in Netherlandish and German Art. *Van Miegroet*

245. Renaissance Art in Florence. *Rice*

246. Italian Renaissance Architecture. *Rice*

247S. Topics in Italian Renaissance Art. *Rice*

- 248. Art of the Netherlands in the Fifteenth Century. *Van Miegroet*
- 249. Aspects of Renaissance Culture. *L. Patterson and Van Miegroet*
- 250. Italian Baroque Architecture. *Rice*
- 252. Art of the Netherlands in the Sixteenth Century. *Van Miegroet*
- 254. German Art in the Fifteenth and Sixteenth Centuries. *Van Miegroet*
- 260S. Topics in Italian Baroque Art. *Rice*

DEPARTMENT OF CLASSICAL STUDIES

- 221. Medieval Latin. *Newton*

DEPARTMENT OF ENGLISH

- 207A. Introduction to Old English. *Staff*
- 207B. Old English Literature. *Staff*
- 208. History of the English Language. *Butters or Tetel*
- 212. Middle English Literature: 1100 to 1500. *L. Patterson*
- 213, 214. Chaucer. *L. Patterson*
- 221. Renaissance Prose and Poetry: 1500 to 1660. *DeNeef, Fish, A. Patterson, Randall, or Schwartz*
- 225. Renaissance Drama: 1500 to 1642. *A. Patterson or Randall*
- 310. Studies in Old English Literature. *Staff*
- 312. Studies in Middle English Literature. *L. Patterson*
- 315. Studies in Chaucer. *Fish or L. Patterson*
- 321. Studies in Renaissance Literature. *DeNeef, Fish, A. Patterson, Porter, Randall, or Schwartz*
- 324. Studies in Shakespeare. *A. Patterson or Porter*
- 329. Studies in Milton. *DeNeef, Fish, A. Patterson, or Schwartz*

DEPARTMENT OF GERMANIC LANGUAGES AND LITERATURE

- 201. Introduction to Middle High German. *Rasmussen*
- 202S. Medieval Seminar. *Rasmussen*
- 203S. Sex, Gender, and Love in Middle High German Literature. *Rasmussen*
- 210S. Renaissance and Reformation. *Borchardt*
- 215S. German Baroque Literature. *Borchardt*
- 260. History of the German Language. *Rasmussen*

DEPARTMENT OF HISTORY

- 221. Topics in the Social and Economic History of Europe, 1200-1700. *Robisheaux*
- 222. Problems in the Intellectual History of the European Renaissance and Reformation. *Witt*
- 237S. Europe in the Early Middle Ages. *Staff*
- 238S. Europe in the High Middle Ages. *Staff*
- 251A. Topics in Intellectual History of Europe, 1250-1450. *Witt*
- 251B. Topics in Intellectual History of Europe, 1450-1650. *Witt*
- 267S. England in the Sixteenth Century. *Herrup*
- 268S. England in the Seventeenth Century. *Herrup*

DEPARTMENT OF MUSIC

- 211. Notation. *Williams*
- 222. Music in the Middle Ages. *Brothers*
- 223. Music in the Renaissance. *Brothers or Silbiger*
- 317S. Seminar in the History of Music. (Topics vary.) *Staff*
- 351S. Studies in Musical Iconography. *Staff*

DEPARTMENT OF PHILOSOPHY

- 218S. Medieval Philosophy. *Mahoney*
- 219S. Late Medieval and Renaissance Philosophy. *Mahoney*

DEPARTMENT OF RELIGION

- 206. The Christian Mystical Tradition in the Medieval Centuries. *Keefe*
- 219. Augustine. *Clark*
- 236. Luther and the Reformation in Germany. *Steinmetz*
- 250. Women in the Medieval Church. *Keefe*
- 272. The Early Medieval Church. *Keefe*
- 337. Theology of St. Thomas Aquinas. *Steinmetz*
- 338. Calvin and the Reformed Tradition. *Steinmetz*
- 339. The Radical Reformation. *Steinmetz*

DEPARTMENT OF ROMANCE STUDIES

French

- 211. History of the French Language. *Thomas*
- 240. Old French Literature. *Solterer*
- 248. French Literature of the Seventeenth Century. *Farrell*
- 325. French Prose of the Sixteenth Century. *Tetel*

326. Topics in Renaissance Poetry. *Tetel*
 391, 392. French Seminar (medieval and Renaissance topics). *Tetel and staff*

Italian

- 284, 285. Dante. *Caserta*

Spanish

210. History of the Spanish Language. *Garci-Gómez*
 258S. Spanish Lyric Poetry before 1700. *Wardropper*
 351. The Origin of Spanish Prose Fiction. *Staff*
 353. Cervantes. *Staff*
 358. Spanish Lyric Poetry before 1700. *Staff*
 391, 392. Hispanic Seminar (medieval and Renaissance topics). *Staff*

COURSES CURRENTLY UNSCHEDULED

- Classical Studies 327. Seminar in Byzantine History
 English 383. Studies in Textual Criticism
 Music 341S. History of Music Theory to Rameau
 Music 361S. Musical Organology
 Religion 241. Problems in Reformation Theology
 Religion 251. Counter-Reformation and Development of Catholic Dogma
 Religion 334. Theology and Reform in the Later Middle Ages
 Religion 344. Zwingli and the Origins of Reformed Theology

Microbiology

Professor Keene, *Acting Chair* (414A Jones); Professor Willett, *Director of Graduate Studies* (420 Jones); Professors Bastia, Bolognesi, Endow, Joklik, and Nevins; Associate Professors Cullen, Kreuzer, Linney, Mitchell, and White; Assistant Professors Garcia-Blanco, Horowitz, Ostrowski, Pickup, Seldin, and Wharton; Professors Emeriti Osterhout and Wheat; Associate Research Professors Burdett and Miller

The Department of Microbiology offers a broadly-based graduate program leading to the Ph.D. degree. It also participates in interdepartmental programs such as the University Program in Genetics, the Program in Cell and Molecular Biology, and the Medical Scientist Training Program. The department's graduate program is designed to provide students with a strong scientific base in the principles and techniques of contemporary bacterial and animal cell biology.

The research interests of the faculty provide numerous and diverse areas for training in prokaryotic and eukaryotic molecular cell biology, molecular genetics and virology, as well as in broad multidisciplinary areas like the nature of protein nucleic acid interactions, the nature of the molecular controls of gene expression, molecular virology, and the function of oncogenes and antioncogenes.

Undergraduate preparation in the biological and physical sciences and in biochemistry is required. A brochure describing the Ph.D. degree program, prerequisites for admission, and research in the department may be obtained by writing the Director of Graduate Studies, Box 3020, Duke University Medical Center, Durham, North Carolina 27710.

214. Fundamentals of Electron Microscopy. Introduction to the basics of transmission electron microscopy. Specimen preparation techniques include: grid preparation, negative staining, metal shadowing, nucleic acid spreading, embedding, and thin sectioning. Students gain experience in the use of the ultramicrotome and electron microscope by working on their own projects. Additional techniques included are ultracryotomy immunoelectron microscopy, freeze-fracture, scanning electron microscopy, and X-ray spectroscopy. C-L: Immunology 214. 3 units. *Miller*

219. Molecular and Cellular Bases of Differentiation. See C-L: Cell Biology 219; also C-L: Biochemistry 219, Immunology 219, and Pathology 219. 3 units. *Counce and staff*

221. Medical Microbiology. An intensive study of common bacteria, viruses, fungi, and parasites which cause disease in humans. The didactic portion of the course focuses on the nature and biological properties of microorganisms causing disease, the manner of their multiplication, and their interaction with the entire host as well as specific organs and cells. 4 units. *Joklik and staff*

246S. Parasitic Diseases. Prerequisites: Microbiology and Immunology 244 or 291, and Biochemistry 227 or equivalent. See C-L: Immunology 246S. 3 units. *Balber*

252. General Virology and Viral Oncology. The first half of the course will be devoted to a discussion of the structure and replication of mammalian and bacterial viruses. The second half deals specifically with retroviruses and transformation, which are discussed in terms of the virus-cell interaction, the relationship of viruses and oncogenes to neoplasia, and the role of the immunological response in retrovirus infections. Consent of instructor required. C-L: Immunology 252. 4 units. *Keene and staff*

259. Molecular Biology I: Proteins and Enzymes. Prerequisite: introductory biochemistry or consent of instructor. See C-L: Cell and Molecular Biology 259; also C-L: Biochemistry 259, Cell Biology 259, and Immunology 259. 3 units. *Richardson and staff*

268. Molecular Biology II: Nucleic Acids. Prerequisites: introductory biochemistry and BCH/CMB/CBI/IMM/MIC 259, or consent of instructor. See C-L: Cell and Molecular Biology 268; also C-L: Biochemistry 268, Cell Biology 268, Immunology 268, and The University Program in Genetics. 4 units. *Steege and staff*

269. Advanced Cell Biology. Prerequisite: introductory cell biology or consent of instructor. See C-L: Cell and Molecular Biology 269; also C-L: Botany 269, Cell Biology 269, Immunology 269, and Zoology 269. 3 units. *Nicklas and staff*

291. Comprehensive Immunology. See C-L: Immunology 291. 4 units. *Krangel and staff*

For Graduates

304. Molecular Membrane Biology. Prerequisite: Microbiology 269 or consent of instructor. See C-L: Immunology 304. 2 units. *Argon*

310. Molecular Development. Selected topics of current research using molecular and genetic approaches to study development and developmental gene regulation. Focus on mammalian development using the mouse, mouse embryonic stem(ES) cells, and mouse teratocarcinoma cells as models. Lectures and student presentations of research on subjects including differential gene regulation, mouse embryos and oocytes, transgenic mice, maternal imprinting, embryonic stem(ES) cells, immune system development, gene mapping, and regulatory gene families. C-L: Immunology 310. 2 units. *Linney*

325. Medical Mycology. Comprehensive lecture and laboratory coverage of all the fungi pathogenic for humans. Practical aspects as well as future trends in the mycology, immunology, diagnosis, pathogenesis, and epidemiology of each mycotic agent will be explored. There will be several invited lecturers, each an internationally recognized scientist, discussing his or her particular area of mycological expertise and current research. Consent of instructor required. 4 units. *Mitchell*

331. Microbiology Seminar. Current topics in microbiology with seminars presented by students, faculty, and outside speakers. Required course for all students specializing in microbiology. 1 unit. *Staff*

COURSES CURRENTLY UNSCHEDULED

282. Molecular Microbiology

323. Topics in Cell and Molecular Biology

324. Topics in Molecular Genetics

Music

Professor Silbiger, *Chair* (105 Mary Duke Biddle Music Building); Assistant Professor Gilliam, *Director of Graduate Studies* (068 Mary Duke Biddle Music Building); Professors Todd and Williams; Associate Professors Bartlet and Jaffe; Assistant Professors Brothers and Lindroth; Associate Professors of the Practice Parkins and Szász; Adjunct Assistant Professor Druesedow; Lecturer Meniker

The Department of Music offers graduate programs leading to the A.M. and Ph.D. degrees in composition, musicology, and performance practice. Students are encouraged to include work outside their main area of concentration within the department. In addition, each of the programs requires course work outside the department.

Applicants for admission to all degree programs will normally have a broad liberal arts background as well as demonstrable musical competence. Those applying to the composition program should submit samples of their compositions with their applications; for the musicology program, applicants should include samples of their writing on musical topics. Upon acceptance to the university, by nomination of the Graduate Faculty in Music, musicology students may also be admitted to the Program in Medieval and Renaissance Studies (see section on Medieval and Renaissance Studies in this bulletin). For the performance practice program, the department encourages applications from advanced musicians who have demonstrated an ability to conduct research about the performance of music in historical contexts. Applicants in performance practice should submit a recording of their work in the field as well as a sample of their writing.

A reading knowledge of one foreign language is required for the A.M. degree; for the Ph.D. degree two languages are required (in performance practice and in musicology, one of these will normally be German). For some dissertation topics a third language may be required.

A detailed description of the requirements for the A.M. and Ph.D. is available upon request from the director of graduate studies.

201. Introduction to Musicology. Methods of research on music and its history, including studies of musical and literary sources, iconography, performance practice, ethnomusicology, and historical analysis, with special attention to the interrelationships of these approaches. 3 units. *Druesedow*

203. Proseminar in Performance Practice. Critical methods in the study of historical performance practice, including the evaluation of evidence provided by musical and theoretical sources, archival and iconographic materials, instruments, and sound recordings. Current issues regarding the performance practice for music from the Middle Ages to the twentieth century. 3 units. *Meniker or Silbiger*

211, 212. Notation. Development and changing function of musical notation from c. 900 to c. 1900, including plainchant notations, black notations, white notations, the invention of printing (particularly movable type and engraving), keyboard and lute tablatures, scores. 3 units each. *Williams*

213. Theories and Notation of Contemporary Music. The diverse languages of contemporary music and their roots in the early twentieth century, with emphasis on the problems and continuity of musical language. Recent composers and their stylistic progenitors: for example Ligeti, Bartók, and Berg; Carter, Schoenberg, Ives, and Copland; Crumb, Messiaen, and Webern; Cage, Varèse, Cowell, and Stockhausen. 3 units. *Jaffe or Lindroth*

215. Music Analysis. Historical, philosophical, and ideological issues raised by music analysis. Intensive study of harmony and voice leading in the works of major tonal composers, with emphasis on the analytic approach of Heinrich Schenker. 3 units. *Todd*

217. Selected Topics in Analysis. An exploration of analytical approaches appropriate to a diversity of music, which may include settings of literary texts, pre-tonal music, and music in oral and vernacular traditions. Prerequisite: Music 215 or consent of instructor. 3 units. *Silbiger*

218. Advanced Counterpoint. Selected topics in modal or tonal contrapuntal practice with emphasis on music writing up to five parts. Consent of instructor required for students not registered for doctoral work in composition. 3 units. *Jaffe, Lindroth, or Williams*

Courses dealing with selected topics in the period concerned, at a level between simple surveys and advanced seminars:

222. Music in the Middle Ages. Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *Brothers*

223. Music in the Renaissance. Selected topics. C-L: Medieval and Renaissance Studies. 3 units. *Brothers or Silbiger*

224. Music in the Baroque Era. Selected topics. 3 units. *Silbiger or Williams*

225. Music in the Classic Era. Selected topics. 3 units. *Bartlet or Todd*

226. Music in the Nineteenth Century. Selected topics. 3 units. *Bartlet, Gilliam, or Todd*

227. Music in the Twentieth Century. Selected topics. 3 units. *Gilliam or Todd*

229. Collegium Musicum. A practicum in music of the Middle Ages and the Renaissance. Rehearsals are held weekly in preparation for public performances (usually one each semester). No credit. *Brothers*

230. Workshop in Performance Practice. Laboratory for application of historically informed performance practice on instruments appropriate to the period of the music studied. Emphasizes instrumental and vocal chamber music. Open to graduates and undergraduates with consent of instructor. No credit. *Meniker*

236. Nineteenth-Century Piano Music. Beethoven, Schubert, Weber, Mendelssohn, Schumann, Chopin, Liszt, and Brahms. The arts of improvisation and transcription, the keyboard virtuoso, the character piece, and the conflict between romantic content and form. 3 units. *Todd*

295S. Composition Seminar. Selected topics in composition. 3 units. *Jaffe or Lindroth*

296S. Analysis of Contemporary Music. Structures, expressive intentions, and functions since 1914. Contemporary orchestral music, American music, European music, popular media, musical tradition, and contemporary composers. Analysis of works performed in the department's Encounters Series with occasional guest composers present. 3 units. *Jaffe or Lindroth*

297, 298, 299. Composition. Weekly independent study sessions at an advanced level with a member of the graduate faculty in composition. 3 units each. *Jaffe or Lindroth*

317S. Seminar in the History of Music. Selected topics. 3 units. *Staff*

318S. Seminar in Performance Practice. A practical seminar in which participants will be expected to perform, to introduce the work to be played or sung, and to outline

its interpretative problems. A list of the music concerned will be posted in advance, and all students will participate in the study (if not necessarily in the performance) of the works announced. It is expected that the seminar will cover most periods, from Gregorian chant to twentieth-century repertoires. Consent of instructor required. 3 units. *Williams*

331, 332, 333. Independent Study in Performance Practice and Interpretation. The exploration of significant interpretive and performance-practice issues as they affect a specific repertory. Weekly meetings with a member of the graduate faculty. Consent of instructor and director of graduate studies required. 3 units each. *Staff*

351S. Studies in Musical Iconography. The history and current trends in musical iconography; iconography as a part of the history of ideas and as *Realienforschung*, "the study of real objects." Discussion of papers in the area of interest of participants. 3 units. *Staff*

382S. Studies in Ethnomusicology. Ethnomusicology as a branch of musicology. Discussion of papers in Southeast Asian music or in the areas of interest of the participants. 3 units. *Staff*

390. Independent Study. With the consent of a graduate faculty member and the approval of the director of graduate studies, the student will undertake a specialized research project of his/her own choosing. 3 units. *Staff*

397, 398, 399. Composition. Weekly independent studies at the doctoral level with a member of the graduate faculty in composition. 3 units each. *Jaffe or Lindroth*

COURSES CURRENTLY UNSCHEDULED

341S. History of Music Theory to Rameau

361S. Musical Organology

Neurobiology

Professor Purves, *Chair* (101I Bryan Research Building); Associate Professor Matthew, *Director of Graduate Studies* (301E Bryan Research Building); Professors Abou-Donia, Diamond, W. C. Hall, W. G. Hall, McClay, McNamara, Roses, Simon, Slotkin, Somjen, and Staddon; Associate Professors Augustine, Cant, Casseday, Corless, Erickson, Fitzpatrick, Katz, Nadler, Schmechel, Skene, Strittmatter, Tyrey, Wolbarsht, and Wong; Assistant Professors Anholt, Boustany, Fremneau, Kauer, LaMantia, Lewis, Lo, Nowicki, Reinhart, and Turner; Professors Emeriti Moore and Robertson; Associate Research Professor Hines; Assistant Research Professors Covey, Crain, Einstein, and Madison

At a time when many questions in biology have been eloquently answered, both scientists and the public correctly perceive that the brain remains, in fundamental ways, a profound mystery. During the last century tremendous advances have been made in understanding the structure, function, chemistry, and development of the brain. Nonetheless, broad and important questions about this complex organ remain to be answered in both biology and medicine. These include how genetic instructions are linked to brain development, the basis of learning and memory, the nature of consciousness, and the etiology and proper treatment of neurological diseases such as epilepsy and Alzheimer's disease.

The ways that neurobiologists approach these problems, while generally reductionist, are diverse. Preeminent are the techniques of molecular biology and molecular genetics, a host of sophisticated electrophysiological methods for detecting the activity of individual nerve cells or groups of nerve cells, and a wealth of anatomical methods for seeing the structure and connections of nerve cells. Novel and increasingly noninvasive means of imaging the nervous system—by nuclear magnetic resonance, detection of

positron emission, or activity related magnetic fields—also hold great promise for better understanding the brain. Despite the power of these methods, progress in neurobiology—much as progress in any science—will depend on a few important insights arising from the imagination of neuroscientists who think deeply about these issues. The purpose of the graduate program in neurobiology is to enable talented students to think about the nervous system at this level.

Neuroscientists at Duke work with the conviction that advances in understanding the brain will come from the application of a wide range of approaches and techniques. This conviction is reflected in the fact that neuroscience at Duke is pursued in a variety of departments and settings, all of which are possible sites for students who wish to be trained in this field. Although much of this research is carried out in the Department of Neurobiology at Duke University Medical Center, several departments on the undergraduate campus also participate in this work. There are now 44 faculty members associated with the graduate program in neurobiology at Duke, and a large and diverse body of students and other professionals engaged in neurobiological research.

Students in the graduate program in neurobiology take a core curriculum that covers the major subfields of contemporary neurobiology, but are generally free to pursue—with the help of faculty advisors—a course of study tailored to their needs, backgrounds, and individual interests. The four core courses in the Department of Neurobiology are 208, Cellular Neurobiology; 209, Systems Neurobiology; 211, Developmental Neurobiology; and 212, Molecular Neurobiology.

202. Basic Neurobiology. A systematic introduction to the structure and function of the mammalian nervous system designed specifically for first-year medical students. Lectures, laboratory exercises, clinical presentations, and problem-solving conferences during the month of January. 4 units. *Purves and staff*

208. Cellular Neurobiology. (Graduate Core Course.) Basic principles of neural electrical activity. Areas of emphasis will include action potential generation, ion channel structure/function relationships, modulation of channel activity, neurotransmitter secretion, transmitter receptors and mechanisms of synaptic plasticity. Consent of instructor required. Spring. C-L: Cell Biology 208. 3 units. *Augustine, Kauer, Lo, and Reinhart*

209. Systems Neurobiology. (Graduate Core Course.) Structure and function of the mammalian sensory and motor systems. Consent of instructor required. Fall. 3 units. *Cant and Fitzpatrick*

210. Individual Study. Directed reading and research in neurobiology. Consent of director of graduate studies required. 3 to 9 units each. Variable credit. *Staff*

211. Developmental Neurobiology. (Graduate Core Course.) The development of the nervous system covering both the history and present status of the major issues in this field. Consent of instructor required. Fall. 3 units. *Katz and Purves*

212. Molecular Neurobiology. (Graduate Core Course.) The macromolecules responsible for the specialized functions of neurons and glia. Topics stress the biochemical, molecular, cellular, and genetic processes involved in the development and function of the mammalian nervous system. Introductory biochemistry is recommended. Consent of instructors required. Spring. 3 units. *LaMantia, Matthew, and Skene*

213. Neurobiology of Disease. Diseases affecting the nervous system, such as Alzheimer's dementia, Duchenne muscular dystrophy, and myasthenia gravis. Description of the clinical manifestations of these diseases, and emphasis on how fundamental mechanisms of biosynthesis, organelle, and neural functions may be disrupted to produce nervous system dysfunction. Consent of instructor required. 1 unit. *Strittmatter, Turner, and staff*

214. The Neural Basis for Sensory-Motor Integration. A fundamental question in neurobiology—how sensory and motor systems interact in the brain to produce adaptive behavior—examined by studying original papers that have contributed to the understanding of the different roles played by the basal ganglia, brainstem, cerebellum, and cortex. Particular attention to a well-studied model behavior, orienting movements of the head and eyes toward the source of an auditory or visual stimulus. Consent of instructors required. 3 units. *Diamond and W. C. Hall*

280. Student Seminar. Preparation and presentation of seminars to students and faculty on topics of broad interest in neurobiology. Required of all first- and second-year neurobiology students. 1 unit. *Augustine and Katz*

311. Neurobiology of the Photoreceptor. Lectures and discussion sessions focus on the photoreceptor as a model neuron for examining current concepts of structure-function relationship, differentiation, signal transduction, and genetic disorders. Spring. Prerequisite: Neurobiology 208, 209, 211, 212 or equivalent recommended. C-L: Cell Biology 311. 1 unit. *Corless and Wong*

320. Neuroethology. A seminar course on the relation between brain function and the natural behavior of animals. Examination of one or two topics, for example, echolocation by bats, electric communication by fish, celestial orientation by bees and birds, temporally patterned complex behaviors. Spring. 3 units. *Casseday*

360. Neuroparmacology. Seminar-lecture course emphasizing neurotransmitter mechanisms and the mechanisms of action of drugs used to modify nervous system function. Material will be drawn from recent literature. Consent of instructor required. C-L: Pharmacology 360. 3 units. *Wilson*

364. Neurotoxicology. See C-L: Pharmacology 364. 3 units. *Abou-Donia and staff*

372. Research in Neurobiology. Laboratory research in various areas of neurobiology. Credit to be arranged. Variable credit. *Staff*

COURSES CURRENTLY UNSCHEDULED

222. Behavioral and Neural Modeling

266S. Comparative Neurobiology

Pathology

Professor Pizzo, *Chair* (301B Davison); Assistant Professor Salvesen, *Director of Graduate Studies* (207 Jones); Professors Adams, D. Bigner, S. Bigner, Bossen, Bradford, Burger, Graham, Jennings, Johnston, Klintworth, Koepke, Reimer, Shelburne, Sommer, and Wittels; Associate Professors Crapo, Elchlepp, Greenberg, Hoffman, Ideker, Kane, Reimer, and Zwadyk; Assistant Professors Abernethy, Crain, Dewhurst, Enghild, Friedman, Jirtle, Lewis, Proia, Schold, and Zalutsky; Associate Research Professor Wikstrand; Assistant Clinical Professor Vollmer; Adjunct Associate Professor Swenberg; Adjunct Assistant Professor Brody

The Department of Pathology offers graduate work leading to the M.S. and Ph.D. degrees with areas of specialization such as subcellular and molecular pathology. Course work is designed to give a broad background in classical and modern pathology with emphasis on the application of modern research techniques. Students will be required to take such courses as are necessary to obtain a broad foundation, as well as courses applicable to areas of specialty and research. Further information including brochures giving details of departmental facilities, staff, trainee stipends, and the M.D.-Ph.D. program are available from the director of graduate studies.

219. Molecular and Cellular Bases of Differentiation. See C-L: Cell Biology 219; also C-L: Biochemistry 219, Immunology 219, and Microbiology 219. 3 units. *Counce and staff*

250. General Pathology. Presentation of the fundamentals of pathology. Senior staff members give lectures developing broad concepts of disease processes. Emphasis is on etiology and pathogenesis of disease. Prerequisites: histology and consent of instructor. 4 units. *Burger and staff*

251. Laboratory Course in General Pathology. Laboratory session to complement Pathology 250. Gross and microscopic material is correlated with and related to disease processes. Pathology 250 may be taken concurrently. Prerequisites: histology and consent of instructor. 4 units. *Burger or staff*

258. Cellular and Subcellular Pathology. This course is designed for students wishing to broaden their knowledge of cellular structure and cellular pathology, and consists of lectures and seminars discussing the alterations in cellular structure and associated functions that accompany cell injury. Consent of instructor required. Hours to be arranged. 2 units. *Shelburne and Sommer*

275. Fundamentals of Electron Microscopy and Biological Microanalysis. Emphasis will be placed on preparative procedures including freezing techniques and on the application of electron microscopy to ultrastructural pathology. Scanning electron microscopy, X-ray microanalysis, and scanning ion microscopy will be discussed in addition to conventional transmission electron microscopy. Limited laboratory experience included. 3 units. *Brody, Ingram, Shelburne, and Sommer*

325. Cardiovascular Pathology. Study of cardiovascular disease processes, reviewing anatomic, embryologic, and physiologic features, and utilizing case material and gross specimens. Consideration of principles of electrocardiography. Consent of instructor required. 3 units. *Jennings and staff*

353. Advanced Neuropathology. Current problems and research methods related to diseases which affect the nervous system. Consent of instructor required. 3 units. *Staff*

357. Research in Pathology. Independent research projects in various fields of pathology. Hours and credit to be arranged. Variable credit. *Graduate faculty*

361, 362. Autopsy Pathology. A detailed consideration of the morphologic, physiologic, and biochemical manifestations of disease. Emphasis is on individual work in the laboratory with tutorial supervision. Gross dissection; histologic examination; processing; analysis of morphologic, microbiologic, and biochemical data; and interpretation of results. For advanced students. 3 to 6 units each. Prerequisites: Pathology 250 and consent of instructor. Variable credit. *Adams and staff*

364. Systemic Pathology. Systematic presentation of the characteristics of disease processes as they affect specific organ systems. Consent of instructor required. 6 units. *Staff*

367. Special Topics in Pathology. Special problems in pathology will be studied with a member of the senior staff; the subject matter will be individually arranged. Hours to be arranged. 2 to 4 units. Variable credit. *Jennings and staff*

369. Ophthalmic Pathology. This course will consist of lectures, seminars, and laboratory sessions. The normal anatomy and embryology of the eye will be reviewed as a basis for the study of the various ocular disease processes. The more common diseases of the eye will be considered in detail. Problems in ophthalmic pathology will be discussed together with methods of solving them. 3 units. *Klintworth*

370. Developmental Pathology and Teratology. A systematic study of disease processes involving the prenatal, natal, and postnatal period. Emphasis on developmental anatomy and teratogenesis. The format includes seminars and clinicopathologic correlations derived from gross and microscopic material. Prerequisites: Pathology 250 and anatomy and histology. 3 units. *Bradford*

374. Pulmonary Pathology and Postmortem Pathophysiology. Emphasis will be on pulmonary pathology and pathophysiology of infectious, metabolic, environmental, and neoplastic diseases, and certain diseases of unknown etiology (e.g., sarcoid, alveolar proteinosis). Ventilatory experiments will be done on excised human lungs. 3 units. *Staff*

377. Pathology of the Kidney. A comprehensive study of pathological, immunological, and clinical features of the glomerulonephritis, and pyelonephritis, as well as of metabolic, congenital, and neoplastic renal disorders. Lectures will be supplemented with gross and microscopic specimens, demonstrations, and special library studies. 3 units. *Sanfilippo*

380. Diagnostic Immunology. Diagnostic and laboratory procedures used in evaluating immunologic diseases: especially autoimmune, infectious, immunodeficiency, immunoproliferative, and hypersensitivity disorders. Emphasis on the theoretical and practical aspects of testing procedures and their proper interpretation. Consent of instructor required. 2 units. *R. Buckley, Sanfilippo, and Zwadyk*

382. General Pathology for Toxicologists. General principles of pathology using examples from human and experimental toxicological disease. Prerequisites: courses in biochemistry, physiology, and histology (histology may be taken concurrently). 3 units. *Graham, Jennings, and pathologists from UNC and Research Triangle Park*

COURSES CURRENTLY UNSCHEDULED

355. Graduate Seminar in Pathology

360. Cytochemistry

381. Cancer Biology

Pharmacology

Professor Means, *Chair* (407 Nanaline H. Duke); Associate Professor Kuhn, *Director of Graduate Studies* (401-I Bryan Research); Professors Abou-Donia, Ellinwood, Kirshner, Mills, Nadler, Schanberg, Slotkin, Stiles, and Strauss; Associate Professors McNamara, Schwartz, Shenolikar, and Whorton; Assistant Professors Fine, Freneau, Heitman, Hellinga, Meyer, Pendergast, VanDongen, and Wang; Professors Emeriti Lack, Ottolenghi, and Wilder; Associate Research Professor Bartolome; Medical Research Professors Elion and Wilson

Pharmacology offers a graduate program which leads to the Ph.D. degree. Training is available in the following specific areas of pharmacology: neuropharmacology, toxicology, developmental, cardiovascular, and endocrine pharmacology, regulation of cell growth and differentiation (cancer pharmacology), cellular signaling and receptor structure and function, and behavioral. Because pharmacology is an interdisciplinary science, the department considers applicants with strong undergraduate backgrounds in biological, chemical, and neural sciences. There is no foreign language requirement.

For Seniors and Graduates

200. Pharmacology: Mode Action of Drugs. Studies and discussion of the pharmacological action of drugs in terms of biochemical and physiological processes. Four lectures, one clinical correlation, and two conferences per week. 5 units. *Nadler and staff*

210, 211. Individual Study and Research. Directed reading and research in pharmacology. Consent of director of graduate studies required. 3 to 9 units each. Variable credit. *Staff*

233. Essentials of Pharmacology. Drug absorption, distribution, excretion and metabolism; pharmacokinetics; Hansch correlation of structure and activity; stereochemistry; drug and hormone receptors and target cell responses. Prerequisites: introductory biology; Chemistry 151L; Mathematics 31 and 32. 4 units. *Slotkin and staff*

234. Interdisciplinary Approach to Pharmacology. Several model systems (cardiovascular, reproductive, neural, and cell cycle) will be used to explore the molecular, biochemical, and physiologic basis of drug action. 4 units. *Shenolikar and staff*

254. Mammalian Toxicology. Principles of toxicology as related to humans. Emphasis on the molecular basis for toxicity of chemical and physical agents. Subjects include metabolism and toxicokinetics, toxicologic evaluation, toxic agents, target organs, toxic effects, environmental toxicity, management of poisoning, epidemiology, risk assessment, and regulatory toxicology. Prerequisites: introductory biology, and Chemistry 151L, or consent of instructor. 4 units. *Abou-Donia and staff*

280. Student Seminar in Pharmacology. Preparation and presentation of seminars to students and faculty on topics of broad interest to pharmacology. Required of all pharmacology graduate students. 2 units. *Whorton*

For Graduates

314. Integrated Case Studies in Toxicology. Students are assigned topics relative to their chosen research discipline in toxicology and are asked to develop case studies to present at a roundtable workshop. Emphasis on review and analysis of toxicological problems from a holistic (multidisciplinary) viewpoint. Offered on demand. C-L: Environment 314. 1 unit. *Abou-Donia and Richardson*

331. Laboratory Methods in Pharmacology. Tutorial laboratory training in various fields of pharmacology including neuropharmacology, cardiovascular pharmacology, biochemical pharmacology, and biophysical pharmacology. Consent of instructor required. 3 to 6 units. Variable credit. *Staff*

347, 348. Seminar in Toxicology. A weekly research seminar throughout the year is required of participants in the Toxicology Program. Students, faculty, and invited speakers present their findings. 1 unit each. *Abou-Donia*

360. Neuropharmacology. Seminar-lecture course emphasizing neurotransmitter mechanisms and the mechanisms of action of drugs used to modify nervous system function. Material will be drawn from recent literature. Consent of instructor required. C-L: Neurobiology 360. 3 units. *Wilson*

364. Neurotoxicology. Adverse effects of drugs and toxicants on the central and peripheral nervous system; target sites and pathophysiological aspects of neurotoxicity; factors affecting neurotoxicity, screening and assessment of neurotoxicity in humans; experimental methodology for detection and screening of chemicals for neurotoxicity. C-L: Neurobiology 364. 3 units. *Abou-Donia and staff*

372. Research in Pharmacology. Laboratory investigation in various areas of pharmacology. Credit to be arranged. Variable credit. *Staff*

417. Cellular Signaling. See C-L: Cell Biology 417; also C-L: Biochemistry 417. 3 units. *Bell, Caron, Casey, Means, and invited lecturers*

423. Neurobiological Basis of Behavior. Survey of neuroanatomical, neurophysiological, neurochemical, and neuropharmacological evidence of central ner-

vous system function as it relates to normal and abnormal behavior. Clinical description, measurement of function, as well as the biological substrates of affective disorders and psychoses will be emphasized. Scientific bases of current therapeutic procedures, especially psychopharmacological, will be examined. Prerequisites: familiarity with basic neuroanatomy, neurophysiology and neuropharmacology is assumed. 4 units. *Ellinwood and staff*

COURSES CURRENTLY UNSCHEDULED

219. Tutorial in Pharmacology

Philosophy

Professor Brandon, *Chair* (201E West Duke); Professor Sanford, *Director of Graduate Studies* (201D West Duke); Professors Golding and Mahoney; Associate Professor Ferejohn and Posy; Assistant Professors Cooper, Lind, and Schmaltz; Professors Emeriti Peach and Welsh

The Department of Philosophy offers graduate work leading to the A.M. and Ph.D. degrees. Tutorial work complements formal instruction. Students may, after taking a balanced program, specialize in any of the following fields: the history of philosophy, logic, philosophy of science, epistemology, metaphysics, philosophy of mind, philosophical analysis, ethics, aesthetics, political philosophy, philosophy of law, philosophy of medicine, and philosophy of religion.

Individual programs of study are developed for each student. Prior to being admitted to candidacy for the Ph.D. degree, the student must demonstrate a competence in one foreign language and must successfully complete a series of essays and examinations covering the following: logic and formal philosophy; value theory; metaphysics, epistemology, and philosophy of science; and the history of philosophy. In these exercises students are expected to combine factual knowledge with critical understanding. Work in a minor or related field, not necessarily confined to any one department, is encouraged but not required. A minor normally includes 6 units for the A.M. or the Ph.D. degree and may include more as a student's program requires or permits.

A student who meets the general requirements of the Graduate School may earn the A.M. degree in philosophy by passing an oral master's examination. This examination, which can be the defense of either a master's thesis or an alternative academic exercise approved by the department and the student's committee, is normally given in the student's fourth term of full-time registration. The examination can be given earlier in two special circumstances:

1. A student with a strong undergraduate background in philosophy who satisfies the department of his or her qualifications by submitting several samples of written work before beginning the program may be admitted to the master's program with the understanding that the master's examination can be given in the second or third term of full-time registration.
2. A student who combines the A.M. program in philosophy with another advanced degree program, such as the programs for the J.D., the M.D., or the Ph.D. in another field, will register as a full-time graduate student of philosophy for only two terms, the minimum registration that meets the general requirements of the Graduate School for the A.M. degree. These two terms of full-time registration need not be consecutive, and their position in the student's overall program is determined in individual cases. A student in a combined program will normally do some work in philosophy while registered in the student's primary program and do some work in the primary field while registered in philosophy. The master's examination can be given in the second term of full-time registration as a philosophy graduate student or in a later term when the student is registered in the primary program. A student in the philosophy

Ph.D. program who meets the general requirements of the Graduate School for the A.M. degree may earn this degree by completing the preliminary exercises for the Ph.D. degree.

A reading knowledge of at least one foreign language, ancient or modern, is required for the Ph.D. degree. Students must satisfy this requirement by the end of the fifth semester of residency. More than one language may be required where this is judged appropriate to the research demanded by the candidate's dissertation.

For Seniors and Graduates

203S. Contemporary Ethical Theories. The nature and justification of basic ethical concepts in the light of the chief ethical theories of twentieth-century British and American philosophers. 3 units. *Golding or Lind*

204S. Philosophy of Law. Natural law theory and positivism; the idea of obligation (legal, political, social, moral); and the relation of law and morality. 3 units. *Golding*

206S. Responsibility. The relationship between responsibility in the law and moral blameworthiness; excuses and defenses; the roles of such concepts as act, intention, motive, ignorance, and causation. 3 units. *Golding*

208S. Political Values. Analysis of the systematic justification of political principles and the political values in the administration of law. 3 units. *Golding*

210. Logic for Computer Science. See C-L: Computer Science 218. 3 units. *Loveland or Nadathur*

211S. Plato. Selected dialogues. C-L: Classical Studies 211S. 3 units. *Ferejohn*

217S. Aristotle. Selected topics. C-L: Classical Studies 217S. 3 units. *Ferejohn*

218S. Medieval Philosophy. Selected problems. C-L: Medieval and Renaissance Studies. 3 units. *Mahoney*

219S. Late Medieval and Renaissance Philosophy. Selected problems. C-L: Medieval and Renaissance Studies. 3 units. *Mahoney*

225S. British Empiricism. A critical study of the writings of Locke, Berkeley, or Hume with special emphasis on problems in the theory of knowledge. 3 units. *Lind or Schmaltz*

227S. Continental Rationalism. A critical study of the writings of Descartes, Spinoza, or Leibniz with special emphasis on problems in the theory of knowledge and metaphysics. 3 units. *Schmaltz*

228S. Recent and Contemporary Philosophy. A critical study of some contemporary movements, with special emphasis on analytic philosophers. 3 units. *Posy*

231S. Kant's Critique of Pure Reason. 3 units. *Posy*

232S. Recent Continental Philosophy. Selected topics. 3 units. *Staff*

233S. Methodology of the Empirical Sciences. Recent philosophical discussion of the concept of a scientific explanation, the nature of laws, theory and observation, probability and induction, and other topics. Consent of instructor required. 3 units. *Brandon or Cooper*

234S. Problems in the Philosophy of Biology. Selected topics, with emphasis on evolutionary biology: the structure of evolutionary theory, adaptation, teleological or teleonomic explanations in biology, reductionism and organicism, the units of selection, and sociobiology. Consent of instructor required. C-L: Botany 234S and Zoology 234S. 3 units. *Brandon*

235S. Nineteenth-Century German Philosophy. A critical examination of the writings of Hegel, Marx, or Nietzsche. 3 units. *Staff*

250S. Topics in Formal Philosophy. Topics selected from formal logic, philosophy of mathematics, philosophy of logic, or philosophy of language. 3 units. *Posy*

251S. Epistemology. Selected topics in the theory of knowledge; for example, conditions of knowledge, scepticism and certainty, perception, memory, knowledge of other minds, and knowledge of necessary truths. 3 units. *Sanford*

252S. Metaphysics. Selected topics: substance, qualities and universals, identity, space, time, causation, and determinism. 3 units. *Sanford*

253S. Philosophy of Mind. Analysis of concepts such as thought and belief; issues such as mind-body relations, thought and action, the nature of persons and personal identity. 3 units. *Sanford*

289S. Environmental Ethics. Selected topics involving values and the environment, for example, extending morality to nature, rights of future generations, environmental aesthetics, diversity and stability, ideological biases in ecological knowledge. Consent of instructor required. C-L: Environment 282S. 3 units. *Cooper*

291S, 292S. Special Fields of Philosophy. 3 units each. *Staff*

For Graduates

300. Problems in the Theory of Value and Judgment. See C-L: Literature 300; also C-L: English 386. 3 units. *B. H. Smith*

311. Philosophy and Medicine. The scope of medicine as a philosophical problem, the concept of health, and investigation of ethical issues arising in medical contexts. Consent of instructor required. 3 units. *Golding*

COURSES CURRENTLY UNSCHEDULED

202S. Aesthetics: The Philosophy of Art

205S. Philosophy of History

230S. The Meaning of Religious Language

254S. Topics in Philosophy of Religion

331, 332. Seminar in Special Fields of Philosophy

Physical Therapy

Professor Bartlett, *Chair* (045 Hospital); Assistant Professor Gwyer, *Director of Graduate Studies* (045 Hospital); Associate Professors Duncan, Schenkman, and Villanueva; Assistant Clinical Professors Chandler, Figuers, and Riordan; Clinical Associates Dore, Lawrence, and Ross; Professors Emeriti Branch and Horton

The Department of Physical Therapy offers an entry level professional program leading to the M.S. degree. To be eligible for admission to the program, applicants must have obtained a baccalaureate degree and have a background in the basic sciences and social sciences, including course work in biology, chemistry, physics, and psychology.

The program is designed to provide for integration of classroom knowledge and clinical learning experiences essential for the competent practice of physical therapy. In view of this integrated curriculum, failure in a major course within a semester would prevent the student from continuing in the program. Major courses are all courses offered by the Department of Physical Therapy as well as required courses offered by

the Departments of Biological Anthropology and Anatomy, and Neurobiology. A grade of F (or noncredit in the case of Physical Therapy 343 and 344) in any of these courses will occasion withdrawal from the program. Program requirements also include a comprehensive examination at the completion of the curriculum and a research project. Further information may be obtained from the Director of Graduate Studies, Department of Physical Therapy, Box 3965, Duke University Medical Center, Durham, North Carolina 27710.

210. Independent Study. Designed for nonmajors. Consent of instructor required. Credit to be arranged. Variable credit. *Staff*

301. Introduction to Scientific Inquiry. Theory and methods of research process, research design, data collection, preparation of a research proposal. 2 units. *Gwyer and staff*

303. Research. Completion of a research project under the supervision of a faculty adviser; instruction in statistical techniques and the use of the computer. 3 to 5 units. Variable credit. *Gwyer and staff*

313. Physical Agents. Physical aspects and physiological effects of selected physical agents, including massage, superficial heat and cold, ultraviolet, diathermy, and ultrasound. 2 units. *Figuers*

314. Electrotherapy and Electrodiagnosis. Physical aspects and therapeutic effects of electrical currents. Electrodiagnostic testing, introduction to electromyography and nerve conduction studies. 1 to 2 units. Variable credit. *Dore*

317. Kinesiology. Fundamentals of arthrology and myology, movement and joint description, surface anatomy, principles of biomechanics and anthropometry. 2 units. *Villanueva*

318. Arthrology and Pathokinesiology. Detailed study of the arthrology and kinesiology of the trunk and limbs during normal and pathological conditions, with emphasis on the sequential electromyographic and joint motion analysis of body segments during selected human movement patterns, including locomotion. 3 units. *Villanueva*

319. Introduction to Evaluation and Patient Care. Orientation to basic patient care skills, including reaction to illness. Introduction to Problem-Oriented Record System. Principles and methods of evaluation, including assessment of muscle function, joint mobility, neurological and respiratory function, posture, gait, and physical level of independence. Opportunities for direct patient care in laboratory and clinic. 3 units. *Ross and Villanueva*

320. Evaluation and Therapeutic Procedures I. Specific assessment of neuromuscular and cardiopulmonary functions. Physiological basis of therapeutic intervention and specific exercise programs. 3 units. *Chandler and staff*

321. Evaluation and Therapeutic Procedures II. Assessment and treatment of specific neuromuscular and cardiopulmonary problems. Introduction to techniques of neuromuscular facilitation. 2 units. *Figuers*

322. Evaluation and Therapeutic Procedures III. Introduction to the neurophysiological basis for evaluation and treatment of children and adults with central nervous system disorders; emphasis on assessment of abnormal movement and selection of appropriate therapeutic programs. Problems associated with spinal cord injuries, methods of therapeutic intervention, and functional testing. 3 units. *Bartlett, Duncan, and Schenkman*

332. Physical Therapy and Health Services: Administration and Issues. Planning, organizing, delivering, and evaluating physical therapy and health services. Examination of health policy and issues. Principles of administration, leadership styles, and management roles. 2 units. *Bartlett and Riordan*

333. Human Development: Pediatrics/Geriatrics. Aspects of normal human development throughout the life cycle. Clinical features and management of common pediatric and geriatric problems. 2 units. *Riordan and staff*

334. Introductory Pathology. Fundamentals of pathology with emphasis on broad concepts of disease. 2 units. *Staff*

335. Orthopedics. Detailed examination of the musculoskeletal system, through lecture and laboratory, and the application of findings to the establishment of physical therapy care plans. Introduction to common orthopedic problems and their medical and surgical management. 2 units. *Lawrence*

336. Medical Sciences. The clinical manifestations and management of common medical and surgical disorders. Lectures by physicians, physical therapists, clinical pharmacists, and other health personnel; selected laboratory experiences. Areas covered include prosthetics and orthotics, burns, rheumatology, cardiopulmonary disorders, neurology, and neurosurgery. Seminars in patient management. 3 units. *Guyver and Ross*

340. Special Topics in Physical Therapy. Opportunity for study under the direction of an individual staff member. Consent of director of graduate studies required. Credit to be arranged. Variable credit. *Staff*

343. Directed Clinical Experience in Physical Therapy II. Full-time supervised clinical learning experiences in physical therapy settings within limited radius of the university. 2 units. *Figuers and clinical staffs*

344. Directed Clinical Experience in Physical Therapy III. Full-time supervised clinical learning experiences in physical therapy settings throughout the country. 3 units. *Figuers and clinical staffs*

COURSES CURRENTLY UNSCHEDULED

302. Research

342. Directed Clinical Experience in Physical Therapy I

Physics

Professor Evans, *Chair* (108 Physics); Professor Robinson, *Director of Graduate Studies* (111 Physics); Professors Behringer, Bilpuch, Fortney, Goshaw, Han, Johnson, Madey, Meyer, Müller, Palmer, Roberson, Thomas, Walker, Walter, and Weller; Associate Professors Greenside, Howell, and Oh; Assistant Professors Gauthier, Lee, Socolar, Springer, and Teitsworth; Professors Emeriti Biedenharn, Fairbank, and Lewis; Research Associate Professors Litvinenko and Tornow; Adjunct Professors Ciftan, Guenther, O'Foghludha, Robl, and Strosio; Adjunct Associate Professor Skatrud; Adjunct Assistant Professor Everitt

The Department of Physics offers graduate work for students wishing to earn the A.M. or Ph.D. degree. In addition to a balanced program of basic graduate courses, the department offers specialized courses and seminars in several fields in which research is being done by faculty and staff. With the help of faculty advisers, students select a course program to fit their individual backgrounds and goals, often including work in a related field. Students are encouraged to begin research work early in their careers.

For Seniors and Graduates

211. Modern Physics. Fundamental concepts of quantum theory applied mainly to study of atomic structure and spectra, and to statistical physics. Prerequisites: Physics 181 and Mathematics 111. 3 units. *Staff*

213. Nonlinear Dynamics. Prerequisites: Computer Science 53, Mathematics 111, and Physics 51L, 52L. See C-L: Computer Science 213. 3 units. *Behringer or Greenside*

214. Introduction to Solid-State Physics. Discussion of solid-state phenomena including crystalline structures, X-ray and particle diffraction in crystals, lattice dynamics, free electron theory of metals, energy bands, and superconductivity, with emphasis on understanding electrical and optical properties of solids. Prerequisite: quantum physics at the level of Physics 143L or Electrical Engineering 211. C-L: Electrical Engineering 214. 3 units. *Teisworth*

215. Introduction to Quantum Mechanics. Fundamental postulates; wave mechanics and elementary applications; operators, eigenvalues, and eigenfunctions; angular momentum and rotations; spin and coupling of angular momenta; perturbation theory, transition rates, and selection rules; identical particles; applications. Prerequisites: Physics 181 and 211; Mathematics 111 and 114 (may be taken concurrently). 3 units. *Müller*

217S, 218S. Advanced Physics Laboratory and Seminar. Experiments involving the fields of electricity, magnetism, heat, optics, and modern physics. 3 units each. *Meyer*

220. Electronics. Basic elements of modern electronics including AC circuits, transfer functions, solid-state circuits, transistor circuits, operational amplifier applications, digital circuits, and computer interfaces. 3 units. *Fortney*

230. Mathematical Methods in the Physical Sciences I. Mathematical methods chosen to aid in the understanding of physical science, including topics in integration, probability, series, complex analysis, Fourier analysis, vector calculus, curvilinear coordinates, matrices, differential equations, and special functions. Includes use of Mathematica for graphical, symbolic, and numerical computation. 3 units. *Palmer*

231. Mathematical Methods in the Physical Sciences II. Mathematical methods chosen to aid in the understanding of physical science, including topics in differential equations, Legendre functions, spherical harmonics, Bessel functions, Green's functions, integral equations, tensors, group theory, Laplace transforms, calculus of variations, and statistics. Includes use of Mathematica for graphical, symbolic, and numerical computation. Prerequisite: Physics 230 or consent of instructor. 3 units. *Palmer*

244. Nuclear and Particle Physics. Current ideas and models in nuclear and particle physics. Experimental methods; nuclear structure; nuclear reactions; families of elementary particles; quarks and gluons; weak interactions. Prerequisite: Physics 211. 3 units. *Staff*

For Graduates

302. Advanced Mechanics. The fundamental principles of Newtonian mechanics, general dynamics of systems of particles and rigid bodies, the methods of Lagrange and Hamilton, generalized mechanics. 3 units. *Fortney or Han*

303. Statistical Mechanics. Fundamental laws of thermodynamics and statistical mechanics with applications to physics and chemistry. Classical and quantum ideal gases; approximate methods for real gases and liquids. Prerequisite: Physics 215. 3 units. *Behringer or Greenside*

304. Advanced Topics in Statistical Mechanics.* This course will vary from year to year. Possible topics include Fermi liquids, systems of bosons, many-body theory, nonequilibrium statistical mechanics. Prerequisites: Physics 303 and 316. 3 units. *Staff*

305. Introduction to Nuclear Physics. Phenomenological aspects of nuclear physics, interaction of gamma radiation and charged particles with matter, nuclear detectors, particle accelerators, radioactivity, basic properties of nuclei, nuclear systematics, nuclear reactions, particle scattering, nuclear models of the deuteron, nuclear forces, parity. 3 units. *Weller*

308. Introduction to High-Energy Physics. An overview of elementary particles and forces studied by experiments carried out at the frontier of high-energy physics. Discussion of basic symmetry principles and conservation laws of nature and review of their experimental tests. Development of the quark model of hadrons and comparisons with observed particle spectra. Review of the Standard Model by comparing predictions to current experimental measurements. 3 units. *Goshaw*

309. Solid-State Physics I. Properties of matter in the condensed state; crystal lattices, electrons in metals and semiconductors, band theory, nonmetallic solids, lattice dynamics, and phonons. Prerequisites: Physics 215 and 303. 3 units. *Teitsworth*

316. Principles of Quantum Theory. Original and fundamental concepts of quantum theory, wave and matrix mechanics, theory of measurements, exclusion principle, and electronic spin. Prerequisites: Physics 215 and 302. 3 units. *Thomas*

317. Intermediate Quantum Theory. General operator methods, angular momentum, Dirac electron theory. Second quantization; symmetry principles and conservation theorems. Applications to the theory of solids, of nuclei, and of elementary particles will be stressed. Prerequisite: Physics 316. 3 units. *Thomas*

318, 319. Electromagnetic Field Theory. Electrodynamics, theory of wave optics, radiation of electric and magnetic multipole fields, special relativity, covariant electrodynamics, Lienard-Wiechert potentials, scattering and dispersion, Hamiltonian field equations. Prerequisite: Physics 182. 3 units each. *Staff*

331. Quantum Optics. The linear and nonlinear interaction of electromagnetic radiation and matter. Topics include simple theory of lasers, second-harmonic generation, photon echos, bistability, Raman scattering, Brillouin scattering, phase conjugation, two photon lasers, and cooling and trapping of atoms. Prerequisites: Physics 230, 231, 316, 317, 318, and 319. 3 units. *Gauthier*

333. Electronic Properties of Submicron Solid-State Devices. Prerequisite: quantum mechanics. See C-L: Electrical Engineering 312. 3 units. *Strosio*

341. Advanced Topics in Quantum Theory. Introduction to relativistic quantum field theory, Lorentz and Poincaré groups, quantization of free fields, interacting fields and S-matrix, applications of quantum electrodynamics and dispersion relations. Prerequisite: Physics 317. 3 units. *Müller*

345. Advanced High Energy Physics. Experimental and theoretical aspects of high energy nuclear processes; properties of mesons and hyperons. 3 units. *Staff*

*Offered on demand.

346. Topics in Theoretical Physics. Structure and long-wavelength properties of condensed matter, mean field theory, elasticity, hydrodynamics, fluctuations, and phase transitions using field theoretic techniques. Prerequisite: Physics 303. 3 units. *Socular*

351, 352. Seminar. A series of weekly discussions on topics related to research projects under investigation in the department. Physics 351, credit, 0 units; Physics 352, 1 unit. Variable credit. *Staff*

361. Physics of Free-Electron Lasers. Seminar course on the basic physical mechanisms and effects responsible for emission and amplification of radiation by electron beams moving through tranverse fields. Prerequisites: Physics 316 and 319. 3 units. *Madey*

COURSES CURRENTLY UNSCHEDULED

240. Computer Applications to Physical Measurement

306. Low Temperature Physics

310. Solid-State Physics II

312. Phase Transitions and Critical Phenomena

330. Nuclear Structure Theory

334. Atomic Physics and Spectroscopy

335. Molecular Spectroscopy

342. Theory of Elementary Particles.

343. Nuclear Physics

344. Advanced Nuclear Physics

397, 398. Low Temperature and Solid-State Seminar

Political Science

Professor Aldrich, *Chair* (214-B Perkins); Associate Professor Gillespie, *Director of Graduate Studies* (308 Perkins); Professors Ascher, Barber, Bates, Fish, Holsti, Horowitz, Hough, Kitschelt, Kornberg, Lange, Paletz, and Spragens; Associate Professors Eldridge, Grieco, Johns, and McKean; Assistant Professors Archer, Bianco, Brehm, Coles, Feaver, Grant, Gronke, Hamilton, Lomperis, Niou, Roberts, Simmons, and Smith; Professors Emeriti Ball, Braibanti, Cleaveland, Grzybowski, Hall, and Leach; Adjunct Professor O'Barr

The Department of Political Science offers graduate work leading to the A.M. and Ph.D. degrees. Before being admitted to candidacy for the Ph.D. degree, an applicant must have qualified for the A.M. degree. Instruction is designed to prepare the student for teaching and research, for government service, and for other work related to public affairs. Before undertaking graduate study in political science, a student is ordinarily expected to have completed at least 12 semester hours of course work in political science. Instruction is currently offered in the following fields: American government and politics, comparative government and politics, political theory, and international relations.

The candidate for the degree of Doctor of Philosophy in political science must take at least fifteen courses in all, including twelve in the department, and demonstrate competence in at least two general fields of the discipline as well as in a third general field or in a specialized subfield or in a field external to the department. The candidate must also fulfill a statistics and/or foreign language requirement.

The terminal degree of Master of Arts, for those who do not intend to continue with doctoral studies, is awarded following successful completion of: (1) eight one-semester courses of 3 units each, at least half of which must be in political science; and (2) either the A.M. thesis or two seminar-length research papers done for Duke courses with a grade of G+ or above (the student will be required to pass an oral exam with either of these options). In addition, candidates for the A.M. degree must demonstrate competence in one foreign language or in statistics.

Further details on the graduate program in political science, the departmental facilities, the staff, and available financial aid may be obtained from the director of graduate studies, Department of Political Science.

For Seniors and Graduates

201S. Problems in International Security (D). Major security issues. Prerequisite: a course in international relations or American foreign policy. 3 units. *Lomperis*

202. American Foreign Economic Policy (D). Formulation and implementation of American foreign economic policy in the twentieth century. Topics include theories of foreign economic policy-making, commercial and monetary policy, energy and agricultural policies, trade and security, aid to developing countries, management of the debt crisis, foreign investment, the industrial policy debate, and multinational corporations and banks. 3 units. *Simmons*

203S. Issues in Politics and the Media in the United States (A). Research seminar analyzing significant questions in the relationship between politics and the media of communication. Consent of instructor required. 3 units. *Paletz*

204S. Ethics in Political Life (C-N). Ethical issues arising in the conduct of political vocations and activities. C-L: Public Policy Studies 204S. 3 units. *Spragens*

205S. The Political Economy of Environmental Resources (B). The rational choice tradition (public goods, collective action, game theory, property rights, new institutionalism) as applied to environmental problems, resource exploitation, environmental justice, and the design of an environmentally sound society. 3 units. *McKean*

207S. American Constitutional Interpretation (A). U.S. Supreme Court interpretation of selected provisions of the Constitution. Prerequisites: Political Science 118 or 127 or 143 and consent of instructor. 3 units. *Fish*

208S. Analyzing the News (A). See C-L: Public Policy Studies 240S. 3 units. *Paletz*

209. Problems in State Government and Politics (A). 3 units. *Staff*

210S. Models in International Relations (D). Emphasis on key theoretical concepts and modeling methodology beginning with basic game theory and decision theory. Such techniques are applied in analysis of deterrence, arms races, balance of power, hegemonic stability, and alliance formation. 3 units. *Niou*

212S. Domestic Structures and Foreign Policies of Advanced Democratic States (D). The influence of democratic institutions on the national-security and foreign-economic policies of advanced industrialized states. 3 units. *Grieco*

213S. Theories of International Political Economy (D). Comparison and assessment of traditional and modern theories in terms of their logical and empirical validity. 3 units. *Grieco*

216S. Evolution of European Marxism (C-N). The central themes in the evolution of European Marxism: socialist thought prior to Marx; the writings of Marx and Engels. The themes are articulated in: Russian Marxism; Soviet Communism and its Marxist critics; the rethinking of Marx's political economy, the theory of the state, and concepts

of class consciousness in the works of twentieth-century European Marxists. 3 units. *Coles*

217. Comparative and Historical Methods (B). See C-L: Sociology 214. 3 units. *Archer, Gereffi, Janoski, Smith, or Tiryakian*

218. Political Thought in the United States (C-N). American political thought through the Civil War period. The Founders and their European antecedents. Debates over the Constitution, slavery, and the Union. 3 units. *Gillespie or Grant*

219S. Film and Politics (A). Analysis of selected film genres and films as they illuminate political behavior. 3 units. *Paletz*

220S. Problems in International Politics (D). Prerequisite: one course in international relations, foreign policy, or diplomatic history. 3 units. *Holsi*

221S. International Institutions and the World Political Economy (D). Examination of theory concerning the role of international institutions in facilitating economic cooperation among advanced democratic states. Investigation of the impact on international economic relations of such multilateral institutions as the International Monetary Fund, the World Bank, the General Agreement on Tariffs and Trade, and the International Energy Agency. 3 units. *Grieco*

222. Introduction to Statistical Analysis (C-E). Basic applications of statistical theory to political questions: research design, hypothesis tests, computer data analysis. Consent of instructor required for undergraduates. 3 units. *Bianco, Brehm, or Gronke*

223. Ancient Political Philosophy (C-N). Intensive analysis of the political philosophy of Plato, Aristotle, and other ancient theorists. 3 units. *Gillespie or Grant*

224S. Modern Political Theory (C-N). A historical survey and philosophical analysis of political theory from the beginning of the seventeenth to the middle of the nineteenth century. The rise of liberalism, the Age of Enlightenment, the romantic and conservative reaction, idealism, and utilitarianism. 3 units. *Grant or Spragens*

225. Topics in Comparative Government and Politics: Western Europe (B). Topics vary: the development of mass democracy and the welfare state; political and electoral participation and mobilization; social movements and political change; center-periphery conflicts; government and bureaucratic institutions and their relationships to society; the modern welfare state and political economy. 3 units. *Kitschelt or Lange*

226S. Theories of International Relations (D). An overview with applications to political-military and political-economic empirical problems. 3 units. *Grieco*

227S. Issues in International Communications (B). Research seminar analyzing selected political issues in international communications. 3 units. *Paletz*

228S. Nineteenth- and Twentieth-Century Political Philosophy (C-N). Topics in nineteenth- and twentieth-century political philosophy, considering such authors as Hegel, Marx, Nietzsche, Kant, Fichte, Dostoevsky, and Heidegger. 3 units. *Coles or Gillespie*

229S. Contemporary Theory of Liberal Democracy (C-N). 3 units. *Spragens*

230S. Introduction to Positive Political Theory (C-E). Basic concepts of political economy, theory of preference and choice, social choice theory, and decision and game theory. 3 units. *Aldrich, Bates, Bianco, or Niou*

231S. Crisis, Choice, and Change in Advanced Democratic States (B). Contributions of Marx, Weber, and Durkheim toward analysis of modern democracies. Examination of selected contemporary studies using these three perspectives to highlight processes of change and crisis. Unsettling effects of markets upon political systems,

consequences of bureaucratic regulation, and transformation of sources of solidarity and integration in modern politics. 3 units. *Kitschelt*

232. Political Economy: Theory and Applications (C-E). Selected topics. 3 units. *Lange*

233. Intermediate Statistical Methods (C-E). Applications of regression models of politics emphasizing the effect of assumptions behind Generalized Least Squares regression. Prerequisite: Political Science 222; consent of instructor required for undergraduates. 3 units. *Bianco, Brehm, or Gronke*

234S. Political Economy of Development: Theories of Change in the Third World (B). Alternative approaches to political economy and social change in the Third World. C-L: Cultural Anthropology 234S, History 234S, and Sociology 234S. 3 units. *Staff*

235S. Comparative Development of Islam (B). Comparative development of Islam in Indonesia, Malaysia, Pakistan, India, North Africa, and sub-Saharan Africa. A comparative analysis of the resurgence of Islam as a religious, political, and cultural force. 3 units. *Staff*

236S. Hegel's Political Philosophy (C-N). Within context of Hegel's total philosophy, an examination of his understanding of phenomenology and the phenomenological basis of political institutions and his understanding of Greek and Christian political life. Selections from *Phenomenology*, *Philosophy of History*, and *Philosophy of Right*. 3 units. *Gillespie*

237S. Comparative Public Policy (B). Introduction to methods, concepts, and theories of comparative public policy analysis. Substantive policies examined in the course vary each semester and may include economic, industrial, social, and civil rights policies. 3 units. *Kitschelt*

238S. Development of United States Courts of the Fourth Circuit (A). Examines judges, courts, and law of United States district and old circuit courts and Court of Appeals: Maryland, Virginia, West Virginia, North Carolina, South Carolina, 1789-1958. 3 units. *Fish*

239. Comparative History and International Relations (D). Forces central to the practice of politics and international relations. Theoretical perspectives include those of Oswald Spengler, Schumpeter, Marx, Weber, and Aron as well as historical cases such as the Russian Revolution, the world wars, the Depression, and the nuclear era. 3 units. *Roberts*

240. American Political Behavior (A). 3 units. *Staff*

241S. The Political Thought of Asia from Manu to Mao (C-N). The development of political thought in Asia emphasizing China and India with consideration of Southeast Asia and Japan. Political treatises of classical India and China, various intellectual responses to European colonialism, and the nationalism, communism, and liberalism of modern Asia. Prerequisites: Political Science 94 or equivalent, and Political Science 132 or equivalent. 3 units. *Lomperis*

243S. Political Applications of Game Theory (C-E). Theory of games as a tool to understand strategic behavior of political actors. Applications to legislative politics, international cooperation, bureaucratic behavior. 3 units. *Bianco or Niu*

244S. The Politics of the European Community (D). Historical, theoretical, and analytical treatment of reform and renewal of the European Community: trade, finance, economic and technological relationships. Impact of European Community development on international relations and American foreign policy. 3 units. *Grieco*

245. Ethics and Policy-Making (C-N). Not open to students who have taken Public Policy Studies 116. See C-L: Public Policy Studies 223. 3 units. *Rapaport*

246S. Political Hypocrisy and Idealism (C-N). The cases for and against hypocrisy in political and social life. The concept of authenticity as the alternative to hypocrisy. Selections from Machiavelli, Shakespeare, Rousseau, Nietzsche, and others. 3 units. *Grant*

247. Politics and Philosophy of Self and Other (C-N). Epistemological, ontological, ethical, and political dimensions of relations between self and other. Theorists may include Husserl, Merleau-Ponty, Levinas, Derrida, Adorno, Gadamer, Sartre, Foucault, and Bakhtin. 3 units. *Coles*

248. The Politics of the Policy Process (A). See C-L: Public Policy Studies 219. 3 units. *Ascher or Mayer*

250S. International Security after the Cold War (D). Contemporary issues in international security: nuclear proliferation, balance of power, the role of force, alternative viewpoints. Consent of instructor required. 3 units. *Feaver*

251S. The American Presidency (A). 3 units. *Paletz*

252S. The Nation-State and the International System (D). The interaction between state structures and the international system. Topics include war, nationalism, and state formation; war and national revolution; imperialism and decolonization; and economic dependency and national autonomy. 3 units. *Grieco*

253S. Comparative Government and the Study of Latin America (B). Current literature on major themes of Latin American politics. 3 units. *Archer*

254S. Essential Global Democracy (A). The failure and success in establishing real democracy, including focus on the main leaders. Issues of law, rights, equality, representation, reasoning, and other principles addressed in the context of practical politics. 3 units. *Barber*

255. Political Sociology (B). See C-L: Sociology 255. 3 units. *Smith or Tiryakian*

256S. Arms Control and National Security Policy (D). The evolution of nuclear weapons and strategy and of global defense policy toward the Soviet Union and other adversaries; the arms control process and nonproliferation. Consent of instructor required. 3 units. *Lomperis*

257S. Making American Defense Policy (D). Theory and practice of politics of national security in the United States. 3 units. *Feaver*

259S. Low Intensity Conflict and the Lessons of Viet Nam (D). The Viet Nam conflict and comparative cases; implications for Western interventions in the Third World. Consent of instructor required. 3 units. *Lomperis*

260S. The Tradition of Political Inquiry (C-N). Past and present problems, goals, presuppositions, and methods. 3 units. *Spragens*

262S. International Communism (B). 3 units. *Hough*

263S. Methods of Political Science (C-E). The relation between theory and evidence; research designs for the comparative analyses of historical and statistical evidence. 3 units. *Roberts*

265S. The Process of International Negotiation (D). See C-L: Public Policy Studies 265S. 3 units. *Mayer*

266S. Comparative Social Policy (B). See C-L: Public Policy Studies 266S. 3 units. *Smith*

267S. Policy-Making in International Organizations (D). See C-L: Public Policy Studies 267S. 3 units. *Ascher*

268. The Regulatory Process (A). See C-L: Public Policy Studies 269. 3 units. *Hamilton*

270S. Fundamentals of Political Economy (C-E). Application of economic reasoning to the study of politics. Analysis of campaigns and elections; legislatures; and the regulation of industries. C-L: Economics 280S. 3 units. *Aldrich, Bates, Bianco, or Niou*

275. The American Party System (A). An intensive examination of selected facets of American national political parties, such as relationships between presidential and congressional politics, the politics of national conventions, recent foreign policy and party alignments, and the controversy over party government. 3 units. *Kornberg*

277. Comparative Party Politics (B). The impact of social and political systems on party structures, functions, ideologies, and leadership recruitment. Emphasis upon research techniques and objectives. 3 units. *Kornberg or Lange*

279S. Political Protest and Collective Mobilization (B). Survey of theories, methods, and empirical studies of political mobilization outside institutional channels; protest behavior and strategies; responses of the state to these challenges; the success of collective mobilization. Emphasis on comparative analyses of protest in advanced industrial democracies. 3 units. *Kitschelt*

282S. Canada (B). See C-L: History 282S; also C-L: Cultural Anthropology 282S, Economics 282S, and Sociology 282S. 3 units. *Cahow or Thompson*

283S. Congressional Policy-Making (A). Lawmaking and oversight of the executive branch by the U.S. Congress. Committee, party, executive, and interest group roles. C-L: Public Policy Studies 283S. 3 units. *Bianco or Gronke*

284S. Public Policy Process in Developing Countries (B). See C-L: Public Policy Studies 284S. 3 units. *Ascher*

293. Federalism (B). Theoretical and operational aspects of federal systems of government, focusing on the United States and Canada. 3 units. *Staff*

299. Advanced Topics in Government and Politics. Topics vary from semester to semester.

A. American Government and Politics

B. Comparative Government and Politics

C. Political Theory

D. International Relations

3 units. *Staff*

For Graduates

303. Seminar on Statistics. Application of advanced statistical methods to political science research problems. Primary focus on multiple regression procedures. Emphasis on assumptions, interpretation of results, and use of the computer. Consent of instructor required. 3 units. *Staff*

304. Classes in American Politics (A). Introduction to fundamental research and theoretic statements in American politics. 3 units. *Aldrich, Bianco, Brehm, or Paletz*

305. Seminar in United States Foreign Policy. Decision making in American foreign policy. The sources, substance, and consequences of United States policy will be examined. The emphasis is on the period since 1945. 3 units. *Holsti*

306. Public Opinion (A). Intensive study of the causes and consequences of public attitudes toward politics, with special attention given to recent research in the field. 3 units. *Brehm or Gronke*

307. Formal Modeling in Political Science. Introduction to formal analysis of recent work in political science. Focus on a number of important theorems and their proofs drawn from such areas as bargaining, deterrence, public goods, collective choice, electoral politics, and new institutionalism. Students will in the process be expected to begin work on formal proofs of their own. Prerequisite: one course in game theory. 3 units. *Niou*

308. Individual Research. Students will conduct research designed to evaluate hypotheses of their choice. Reports on the research must be presented in appropriate professional style. 3 units. *Staff*

309. Seminar in International Relations. Critical survey of theories and research in international relations and foreign policy. Emphasis will be placed on the interrelation between theory and research. 3 units. *Holsti*

310. Scope and Methods in Political Science. Designed to explore philosophical assumptions in political science, theory, and matters of evidence and judgment, the course is meant to be an introduction to variations in research design, empirical methods, and the execution of research. 3 units. *Staff*

312. Electoral Behavior (A). Survey of major themes and controversies in electoral behavior research. Aggregate and individual level analyses of elections; historical and contemporary trends in voting behavior. 3 units. *Gronke*

313. Seminar in Political Communications. A field survey with emphasis on politics and media in the United States. 3 units. *Paletz*

315. Noncooperative Game Theory. See C-L: Economics 315; also C-L: Statistics 386. 3 units. *Meurer or Moulin*

320. Political Psychology. Examination of the human political situation through the study of actual problems and solutions at the level of: (1) the individual, (2) political discourse among government officials, (3) public discourse in the media. 3 units. *Barber*

321. Seminar in Political Theory. Prerequisite: 6 units in political science elected from 223, 224, 229, 231, or their equivalents. 3 units. *Staff*

322. Topics in Early Modern Political Thought. Selected readings from political thinkers ranging from Machiavelli to Mill. 3 units. *Grant or Spragens*

324. Seminar in Comparative Politics (A). A field survey with emphasis on the politics of developing areas. Note: it is generally expected that political science graduate students taking comparative politics as a preliminary field will take both this course and Political Science 325. 3 units. *Staff*

325. Seminar in Comparative Politics (B). A field survey with emphasis on the politics of advanced industrial democracies. Note: it is generally expected that political science graduate students taking comparative politics as a preliminary field will take both this course and Political Science 324. 3 units. *Staff*

326. Research Seminar in Comparative Government and Politics. Seminar in major issues in comparative politics and intensive individual student research projects. 3 units. *Staff*

327. Comparative Political Behavior. This seminar critically examines research on variations in elite and mass behavior as well as the conditions affecting that behavior in a variety of Western countries. 3 units. *Kornberg*

332. Seminar on Political Economy: Micro Level. Survey of recent work in political science and economics on the organization of institutions: political, sociological, and economic. Focus upon the ways in which rational choice theory is applied to areas outside of economics. 3 units. *Bates*

333. Seminar in Political Economy: Macro Level. Survey and analysis of recent work in political science, economics and sociology on the relationships between states and markets. Special emphasis on the ways states influence market outcomes and the ways the organization of power in markets influences state behavior, especially in democratic systems. 3 units. *Lange*

340. Seminar in American Politics and Institutions. Survey, analysis, and critique of the literature. 3 units. *Paletz or staff*

341. Legislative Politics. Survey of current research on the legislative branch of government. Topics include: elections, committee systems, oversight, party organizations, and others. 3 units. *Bianco*

351. Comparative Law and Politics: Ethnic Group Relations (B). Various approaches to the reduction of conflict in deeply divided societies, primarily in Asia and Africa, with secondary attention to Western countries. The nature of ethnic identity, the sources of group conflict, and the forms and patterns it takes. Methods of analyzing social science materials and utilizing them for the design of politics, laws, and institutions. Consent of instructor required. 3 units. *Horowitz*

381. Research Seminar in Latin American Government and Politics. Prerequisite: Political Science 253 or equivalent. 3 units. *Staff*

390. Research Seminar in International Relations. Prerequisite: Political Science 226, Political Science 309 or equivalent. 3 units. *Holsti*

397. Selected Topics in Government and Politics. Topics vary from semester to semester. 2 units. *Staff*

398. Selected Topics in Government and Politics. Topics vary from semester to semester. 3 units. *Staff*

COURSES CURRENTLY UNSCHEDULED

211S. Current Problems and Issues in Japanese Politics (B)

214S. The Politics of Scarcity (B)

215S. Philosophical Bases of Political Economy and Society (C-E)

261. Politics and the Future (D)

264S. Feminist Theory and the Social Sciences (C-N)

280S. Comparative Government and Politics: Sub-Saharan Africa (B)

360. Seminar in Government and Politics in the Soviet Union

RELATED COURSE WORK IN THE SCHOOL OF LAW

It is possible to receive graduate credit for course work completed in the Duke University School of Law, under regulations referred to in this bulletin under the section on academic regulations.

Psychology: Experimental

Professor Lockhead, *Chair* (224 Sociology-Psychology); Professor Eckerman, *Director of Graduate Studies*; Professors Bettman, C. Erickson, R. Erickson, W. C. Hall, W. G. Hall, Hasher, Holland, Marsh, Palmer, Payne, Rubin, S. Schiffman, Staddon, and M. Wallach; Associate Professors Day and Putallaz; Assistant Professors Mazuka, Needham, and Nowicki; Research Professors Crovitz and L. Wallach; Professors Emeriti Diamond, Kimble, Kremen, and Wing

The department offers graduate work leading to the Ph.D. degree. The areas of concentration are cognitive and sensory sciences, behavioral neuroscience, and developmental psychology. Graduate training in developmental psychology is a collaborative effort with the Department of Psychology: Social and Health Sciences. A brochure is available from the director of graduate studies which describes training in each area in more detail and gives information on financial assistance, facilities, and current research activities. The department has no foreign language requirement.

For Seniors and Graduates

204S. Great Ideas in Psychology. Ideas in psychology drawn from various content areas (for example, perception, personality, motivation, biological bases, social, cognitive, developmental, learning, clinical) and various methodological approaches (for example, experimental, introspection, observation, interview, longitudinal, simulation). 3 units. *Day*

205S. Children's Peer Relations. Consent of instructor required. See C-L: Psychology: Social and Health Sciences 205S. 3 units. *Putallaz*

210S. Cognition. Schematic view of cognitive psychology plus intensive study of two to three specific research topics such as forms of representation, individual differences, and problem-solving models. Emphasis on alternative experimental and theoretical approaches. Prerequisite: Psychology 107 or graduate status. 3 units. *Day*

212S. Human Memory. Classical and modern literature, data, and theories relating to mechanisms of information processing, storage, and retrieval. 3 units. *Hasher or Rubin*

214S. Development of Social Interaction. Major concepts and methods pertaining to early social development, emphasizing human social behavior and a developmental psychobiological approach. C-L: Psychology: Social and Health Sciences 214S. 3 units. *Eckerman*

215S. Cognitive Development. Intensive critical evaluation of major approaches to the development of knowledge, including those of Piaget, Thomas Kuhn, Vygotsky, Eleanor Gibson, Kohlberg, and others. C-L: Psychology: Social and Health Sciences 215S. 3 units. *L. Wallach*

219S. Physiological Foundations of Psychology. Structure and function of the nervous system as related to problems of sensory-motor processes, learning, motivation, and memory. 3 units. *C. Erickson and R. Erickson*

220S. Psycholinguistics. Selected topics such as neurolinguistics, linguistic versus pictorial representation, individual differences, oral versus written expression, language

and personality, and the language-thought interaction. Prerequisites: Psychology 134 and consent of instructor or graduate status. 3 units. *Day*

222. Behavioral and Neural Modeling. The nervous system as controller of adaptive behavior. Basic facts and principles of perception, learning, and memory. Theory of neural networks. Formal networks as models for behavior and neural systems. C-L: Neurobiology 222. 3 units. *Staddon and staff*

230S. Social Behavior of Animals. Developmental, ecological, and physiological aspects of territorial, sexual, parental, and aggressive behavior. Consent of instructor required. 3 units. *C. Erickson*

234S. Advanced Personality. Selected topics of current interest concerning empirical research on personality. Strategies for the definition of research questions and the evaluation of research progress. Consent of instructor required. C-L: Psychology: Social and Health Sciences 234S. 3 units. *M. Wallach*

261S. Advanced Learning Theory. Selected topics in the data and theory of basic processes of learning, memory, and motivation in animals and humans. Emphasis on the nature of theory construction and evaluation, and the relation of current perspectives to older ones. Prerequisite: graduate status. 3 units. *Holland*

270S, A-R, U-Z. Selected Problems. 3 units. *Staff*

For Graduates

315. Seminar in Consumer Behavior. See C-L: Business Administration 562; also C-L: Psychology: Social and Health Sciences 315. 3 units. *Bettman*

316. Behavioral Decision Theory. See C-L: Business Administration 525; also C-L: Psychology: Social and Health Sciences 316. 3 units. *Payne*

329-330. Proseminar in Psychology. A historically oriented, team-taught course introducing graduate students to important ideas and discoveries in scientific psychology. 6 units. *Staff*

332. Developmental Psychopathology. See C-L: Psychology: Social and Health Sciences 332. 3 units. *Lochman and Thompson*

349-350. Practicum in Psychological Research. 6 units. *Staff*

352. Child Assessment. See C-L: Psychology: Social and Health Sciences 352. 3 units. *Coie and Putallaz*

396. Graded Research. 1 to 3 units. Variable credit. *Staff*

398. Special Readings in Psychology. 3 units. *Staff*

COURSES CURRENTLY UNSCHEDULED

203S. Sensation and Perception

266S. Comparative Neurobiology

309. Seminar in Learning

310. Seminar in Perception

337. Seminar in Sensory Discrimination

Psychology: Social and Health Sciences

Professor Costanzo, *Chair*; Professor Craighead, *Director of Graduate Studies*; Professors Bettman, Brodie, Carson, Coie, Eckerman, George, Hamilton, Hasher, Martin Lakin, Maddox, Payne, Roth, Surwit, Thompson, Vidmar, M. Wallach, Weiss, and Williams; Associate Professors Anderson, Blumenthal, Curry, Keefe, Linville, Lochman, Logue, Putallaz, Roth, Sheppard, and Spenner; Assistant Professors Emery, Fischer, Fredrickson, Gil, and Mazuka; Professors Emeriti Alexander, Borstelmann, and H. Schiffman; Assistant Professors of the Practice Musia Lakin and Terry; Research Professor Goldstein; Adjunct Professor L. Wallach; Assistant Research Professor Madden; Research Scholar Fairbank

The department offers graduate work leading to the Ph.D. degree in psychology. The program faculty listed above are each members of the department, however, some have their primary appointment in other units of the University including the Business School, Law School, and Medical School. Concentrations of Ph.D. study are: clinical (including developmental psychopathology, adult, and health tracks); human cognition; personality/social; and social and applied developmental psychology. There is particular interest in the conjunction between basic perspectives in psychology and their applied and policy-related derivatives. In addition, the department collaborates with the Department of Psychology: Experimental in the conduct of a Ph.D. concentration in developmental psychology. A brochure is available from the director of graduate studies which describes the programs in more detail and gives information on financial assistance, facilities, and current research activities. The department has no foreign language requirement.

For Seniors and Graduates

205S. Children's Peer Relations. An examination of the empirical literature with emphasis on the functions that peers serve for children, the developmental course of these relationships, the clinical ramifications and possible explanations for inadequate peer relations (including an examination of the family's role), and interventions used to improve children's relationships with their peers. Consent of instructor required. C-L: Psychology: Experimental 205S. 3 units. *Putallaz*

206S. Pediatric Psychology. The conceptual and methodological bases for the field. Case material illustrating how developmental, biological, and psychosocial processes act together in child health and illness. Focus on adjustment and coping with illness and treatments related to cystic fibrosis, sickle cell disease, cancer, diabetes, and seizure disorders. Consent of instructor required. 3 units. *Thompson*

208S. Emotion. An analysis of theoretical and empirical approaches to understanding emotions, with an emphasis on the functions emotion serves in people's lives. Both classic and contemporary research literatures. Prerequisites: Psychology 108 and consent of instructor, or graduate status. 3 units. *Fredrickson*

214S. Development of Social Interaction. See C-L: Psychology: Experimental 214S. 3 units. *Eckerman*

215S. Cognitive Development. See C-L: Psychology: Experimental 215S. 3 units. *L. Wallach*

217S. Advanced Social Psychology. The psychology of interpersonal influence and control; the cognitive and social factors affecting the perception of persons and social action; the dynamics of interpersonal relations and relationship formation and change; the contribution of individual differences to social behavior. Applications in environmental psychology, social psychology and law, and organizational psychology. 3 units. *Costanzo*

218S. Personality, Stress, and Disease. The interaction between person and social environment as a contributor to development of physical disease. Both epidemiological and laboratory-based research considered. Prerequisite: Psychology 109, consent of instructor, or graduate status. 3 units. *Williams*

227S. Behavioral Physiology: Basic Systems. Organ systems review of physiology, emphasizing the role of the central nervous system and behavior in physiological function. 3 units. *Surwit and Weiss*

228S. Behavioral Physiology: Stress and Disease. Physiological processes involved in stress and coping; effects on nervous, cardiovascular, immune, and endocrine systems; how stress influences various disorders, that is, depression, cardiovascular disease, and diabetes. 3 units. *Surwit and Weiss*

234S. Advanced Personality. Consent of instructor required. See C-L: Psychology: Experimental 234S. 3 units. *M. Wallach*

255S-256S. Life-Span Development I and II. Behavioral and psychological development. 255S: the origins and course of cognitive and emotional development (including language, memory, achievement, affective regulation of behavioral process). 256S: components of personality and social development (including attachment relations, self esteem, social interactive process, moral development). Broad issues in the interrelationships of environmental context and individual phenomenon in the emergence of these processes. Longitudinal and cross-sectional approaches to the empirical examination of life course phenomenon. Applications to models of both normative and pathological development. 6 units. *Costanzo and staff*

264S. Hormones, Gender, and Behavior. Hormone effect on behavior in animals and humans with topics including pubertal, menstrual cycle, sex, and gender-related effects on mood, behavior, cognition, and health. 3 units. *Hamilton*

271S, A-R, U-Z. Selected Problems. 3 units. *Staff*

273. Statistics I. Foundations of probability and statistical inference. Introduction to the general linear model via multiple regression. Emphasis on application via statistical computing with SAS. Consent of instructor required. 3 units. *Terry*

274. Statistics II. Basic and advanced ANOVA models via the GLM. Broad-based overview of multivariate models, including MANOVA, canonical correlation, discriminant analysis, and factor analytic models. Emphasis on application and use of computer packages. Prerequisites: Psychology: Social and Health Sciences 273 or consent of instructor. 3 units. *Terry*

288S. Advanced Topics in Social Science and Law. Study of one broad domain in social science and law; exact content area to vary by semester. Emphasizes how empirical findings in social science are translated and used by the legal system. Possible areas include women's legal issues, family violence, expert testimony, employment discrimination. Prerequisite: graduate status. 3 units. *Fischer*

289S. Psychology of Prevention. Concepts of prevention and mental health promotion; community psychology and social systems; epidemiology and prediction of disorder; intervention strategies; evaluation of prevention trials; and ethical and cultural issues. 3 units. *Coie*

For Graduates

301. Group Psychotherapy and Group Influence Processes. Theories of group interventions and group techniques. 3 units. *Lakin*

302. Personality Theory. An advanced course in the representative theories of human functioning, from Freud to contemporary approaches. 3 units. *Staff*

304-305. Personality and Psychopathology, I and II. Semester one considers perspectives and fundamental principles in the study of personality. Semester two is devoted to the implications of these principles for psychopathology and behavior disorders and for the classification of abnormal behavior. 6 units. *Staff*

307. Models of Intervention and Prevention. Concepts of prevention and mental health promotion; community psychology and social systems; epidemiology and prediction of disorder; intervention strategies; evaluation of prevention trials; and ethical and cultural issues. Specific approaches to psychotherapy and psychoeducational therapy will be discussed in relation to the prevention-intervention continuum. 3 units. *Staff*

311-312. Introduction to Graduate Study in Clinical Psychology. Provides brief coverage of the history of psychology in general, and clinical psychology in particular. Acquaints students with research and clinical work of faculty, and introduces them to elementary questions of ethics in human research, treatment, and prevention. Credit/no credit. No credit. *Craighead and Costanzo*

315. Seminar in Consumer Behavior. See C-L: Business Administration 562; also C-L: Psychology: Experimental 315. 3 units. *Bettman*

316. Behavioral Decision Theory. See C-L: Business Administration 525; also C-L: Psychology: Experimental 316. 3 units. *Payne*

318. Research Design. Examines the foundations of psychological and scientific inquiry. Emphasis is on applications that are likely to be encountered by the research psychologist. Prerequisite: advanced graduate-level statistics course or equivalent. 3 units. *Terry*

323, 324. Seminar in Community Psychology. An examination of the organization and functioning of community systems and an exploration of factors involved in system changes through psychologically based intervention strategies. On-line experiences with school system consultation will provide a primary basis for study. 3 units each. *Alexander or Costanzo*

332. Developmental Psychopathology. Consideration of major psychopathological disorders in childhood and adolescence, theories and research on etiology and prediction of disorder. C-L: Psychology: Experimental 332. 3 units. *Lochman and Thompson*

335-336. Personality Assessment. First semester: personality assessment through interviews and the study of personal documents. Second semester: personality assessment through the study of formal tests, objective and projective. 6 units. *Alexander*

339. Ethics for Psychotherapists. A course for graduate students in the clinical program. 3 units. *Lakin*

343-344. Clinical Practicum. Intensive experience and supervision in clinical intervention processes. Student training in psychotherapy strategies and techniques and in clinical consultation skills is conducted in clinical settings. 0 to 6 units. Variable credit. *Staff*

348. Psychotherapy with Children and Families. Major theoretical approaches to clinical intervention with children and adolescents, either individually or in the family system context. 3 units. *Coie*

352. Child Assessment. Interview methods; intelligence and achievement testing; personality and developmental batteries; peer, teacher, and parental instruments; and observational techniques. C-L: Psychology: Experimental 352. 3 units. *Coie and Putallaz*

353. Research Practicum in Prevention. Students will be involved in a short-term research apprenticeship to a faculty member other than their mentor for hands-on experience with research efforts pertinent to the prevention of illness. 3 units. *Staff*

397. Graded Research. 1 to 3 units. Variable credit. *Staff*

399. Special Readings in Psychology. 3 units. *Staff*

COURSES CURRENTLY UNSCHEDULED

207S. Topics in Psychobiology

284S. Feminist Theory and the Social Sciences

Public Policy Studies

Professor Kuniholm, *Chair* (214 Old Chemistry); Professor Ladd, *Director of Graduate Studies* (112 Old Chemistry); Professors Ascher, Barber (political science), Behn, Clotfelter, Cook, Fleishman (law), Gillis, Healy (environment), Hough (political science), Magat (business), Pearsall (engineering), and Price (political science); Associate Professors Conrad, Leitzel, Lipscomb, McConahay, and Rapaport; Assistant Professors Gentry (economics), Hamilton, Mayer, Miranda, Smith, and Sprinkle (health policy and pediatrics); Professors of the Practice Boothby, Harris, and Stubbing; Assistant Research Professor Malson; Adjunct Professor Yaggy; Visiting Assistant Professors Miller and Ramachandran; Lecturer Payne; Visiting Lecturer Ammarell

The graduate program in public policy studies is offered through the Terry Sanford Institute of Public Policy. The objective of the program is to prepare students for jobs, particularly in the public sector, which require analytical skills and a practical understanding of the processes by which policy is made and implemented.

The Master of Public Policy (M.P.P.) degree requires two academic years and a summer internship. The first year is devoted to core courses in policy analysis, including sequences in quantitative methods, economics, political analysis, and ethics. The summer internship is arranged with a federal, state, or local agency of government, a not-for-profit organization, or business. The second-year curriculum includes course work in public management and macroeconomics, electives in substantive policy areas, and a master's "memo" to be researched and written on a problem of current policy concern.

Students who are concurrently enrolled in a Ph.D. program or a professional degree program (M.D., J.D., M.B.A., etc.), or who have already obtained such a degree, can apply for an abbreviated version of the M.P.P. program. Such students are excused from most second-year requirements, so ordinarily the M.P.P. can be completed in one additional year. Students usually apply for a joint degree program simultaneously with their applications to the graduate departments or professional schools, or during their first or second year of advanced study.

The institute does not award a Ph.D.

More information concerning the M.P.P. programs can be obtained by writing the director of graduate studies.

For Seniors and Graduates

204S. Ethics in Political Life. See C-L: Political Science 204S. 3 units. *Spragens*

216S. Economics of Education. Prerequisite: Economics 149 or Public Policy Studies 110. See C-L: Economics 216S. 3 units. *Clotfelter*

217. Microeconomics and Public Policy-Making. Consumption and production theory, welfare economics, theories of collective choice, market structures and regula-

tion, and nonmarket decision making. Not open to students who have taken Public Policy Studies 110. 3 units. *Clotfelter or Ladd*

218. Macroeconomic Policy. Survey of macroeconomic theory and analysis of policies designed to reduce unemployment, stimulate economic growth, and stabilize prices. Conventional monetary and fiscal instruments, employment policies, and new policies designed to combat inflation. C-L: Economics 218. 3 units. *Leitzel*

219. The Politics of the Policy Process. The formulation of public policies, substantive policies in a variety of contexts from local government to international affairs; the role of legislatures, interest groups, chief executives, and the bureaucracy in defining alternatives and in shaping policy from agenda formulation to implementation. Not open to students who have taken Public Policy Studies 114. C-L: Political Science 248. 3 units. *Ascher or Mayer*

221. Decision Analysis for Public Policymakers. Methods for structuring decision dilemmas and decomposing complex problems, assessing the probabilities of uncertain consequences of alternative decisions, appraising the decision maker's preferences for these consequences and for reexamining the decision. Not open to students who have taken Public Policy Studies 55D. 3 units. *Behn or Leitzel*

222. Statistics and Data Analysis for Policymakers. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210B, or 213. See C-L: Statistics 210A. 3 units. *Staff*

223. Ethics and Policy-Making. Normative concepts in politics, liberty, justice, and the public interest: historical and philosophical roots, relationship to one another and to American political tradition, and implications for domestic and international problems. Not open to students who have taken Public Policy Studies 116. C-L: Political Science 245. 3 units. *Rapaport*

231. Quantitative Evaluation Methods. Problems in quantifying policy target variables such as unemployment, crime, and poverty. Experimental and nonexperimental methods for evaluating the effect of public programs, including topics in experimental design, regression analysis, and simulation. Prerequisite: Public Policy Studies 222 or equivalent. 3 units. *Cook or McConahay*

232. Microeconomics: Policy Applications. Cost benefit analysis of public programs. Public utility regulation, pollution regulation, hospital rate setting, regulation of product safety. Quantitative methods and microeconomic theory for analysis of both normative and positive aspects of economic policy. Prerequisites: Public Policy Studies 110 or 217 or Economics 149 and familiarity with regression analysis or concurrent enrollment in Public Policy Studies 231. C-L: Economics 232. 3 units. *Conrad or Ladd*

236, 237. Public Management I and II: Managing Public Agencies. 236: operations management, information and performance, personnel management, public sector marketing. 237: organizational strategy, organizational structure and design, leadership and motivation, labor negotiations. Prerequisite: for 237: Public Policy Studies 236. 3 units each. *Behn or Yaggy*

238. Public Budgeting and Financial Management. Fund accounting for government; techniques of financial analysis, including break-even analysis, cost accounting, cash-flow analysis, and capital budgeting; and governmental budgeting, including the budgetary process and reforms, and the budget crunch in the public sector. 3 units. *Stubbing*

240S. Analyzing the News. Research seminar on political messages and effects of media. Methods and findings of content analysis, survey research, critical theory,

semiology; research project integrating these approaches. C-L: Political Science 208S. 3 units. *Paletz*

241. Reporting the American People. Critical analysis of the sources of information the media rely upon in reporting opinion and policy preferences: opinion polls, bell-wethers, informed elites. Includes the design and execution of a public opinion poll on a topic of local or national interest. 3 units. *McConahay*

245S. Leadership Tutorial. Analysis of techniques, personal qualities, and organizational factors that help or hinder effective leadership. Practical experience in evaluation of leadership efforts. Prerequisite: Public Policy Studies 145D or consent of instructor. 3 units. *Boothby or Payne*

250S. Policy, Philanthropy, and the Arts. Democratic and aesthetic values in relation to past and present patterns of public, corporate, and philanthropic support for the arts. The uses of art criticism and political theory in evaluating subsidies, grants, tax incentives, and censorship. 3 units. *Payne*

251S. Regulation of Vice and Substance Abuse. Focus on activities that have traditionally been defined as vices (including drinking, smoking, use of opiates, gambling, pornography, prostitution) and the problems of regulating and controlling them in a free society. Evaluation of social costs and benefits of various alternative policy interventions. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Economics 251S. 3 units. *Cook*

252S. United States Strategic Arms Policy. Defense, nuclear and conventional force issues since World War II, the workings of the defense establishment, and the impact of the end of the Cold War. Not open to students who have taken Public Policy Studies 264S.18. 3 units. *Stubbing*

253. The Politics of Health Care. The history, status, and future of health care policy. Grounded in political theories such as distributive justice, altruism, and contractarianism. Focus on policy formation. Case discussions of American reform controversies in light of international experience. 3 units. *Sprinkle*

255. Health Policy Analysis. Group analysis of a current health-policy problem. Project involves background research, data acquisition, analysis, writing, and presentation of a substantial policy report. Designed for candidates seeking the undergraduate certificate in health policy. Consent of instructor required. 3 units. *Staff*

256. The Economics of Health Care. The health care industry and government policies designed to alter market demand and supply relationships: national health insurance, the relationship between insurance, supply constraints, and inflation; the supply and distribution of health manpower; hospital cost containment policy. Prerequisite: Economics 149 or the equivalent or consent of instructor. 3 units. *Lipscomb*

257. United States Policy in the Middle East. From World War II to the present with a focus on current policy options. 3 units. *Kuniholm*

259S. State and Local Public Finance. Analysis of state and local revenue sources, intergovernmental fiscal relations, budgets and expenditures, fiscal aspects of economic development, and the municipal bond market. Policy topics include financing schools and transportation systems, tax policy, and current fiscal issues. Prerequisite: Public Policy Studies 217 or equivalent. C-L: Economics 259S. 3 units. *Ladd*

260. Economic Policy Analysis of Nonrenewable Resources. Economic analysis of nonrenewable resources, development, and exploration. Relationship between natural resources and other economic sectors. Emphasis on public policy tax and regulatory policy, natural resources in developing economies and foreign investment in the mining

sector. Prerequisite: Economics 149, Public Policy Studies 110, or Public Policy Studies 232. C-L: Economics 260. 3 units. *Conrad*

261. Evaluation of Public Expenditures. Basic development of cost benefit analysis from alternative points of view, for example, equity debt, and economy as a whole. Techniques include: construction of cash flows, alternative investment rules, inflation adjustments, optimal timing and duration of projects, private and social pricing. Adjustments for economic distortions, foreign exchange adjustments, risk and income distribution examined in the context of present value rules. Examples and cases from both developed and developing countries. C-L: Economics 261 and Environment 272. 3 units. *Conrad*

262S. Seminar in Applied Project Evaluation. Initiate, develop, and perform a project evaluation. Range of topics include measuring the social cost of deforestation, the B1 Bomber, a child nutrition program, the local arts program. Prerequisite: Economics 285 or Public Policy Studies 261. C-L: Economics 262S. 3 units. *Conrad*

264S. Research Seminar: Topics in Public Policy I. Selected topics. 3 units. *Staff*

265S. The Process of International Negotiation. Negotiations between governments or between international institutions and governments. Explorations of historic cases, such as the U.S.-Canada Free Trade Negotiation, the INF Talks, and Camp David Summit. C-L: Political Science 265S. 3 units. *Mayer*

266S. Comparative Social Policy. An emphasis on advanced industrial countries. The seminar will explore the relationship between political process and public policy by making cross-national comparisons; introduce the major policy questions in the field of social policy; and provide students with some knowledge of the substance of social policy in different countries. C-L: Political Science 266S. 3 units. *Smith*

267S. Policy-Making in International Organizations. Emphasis on international financial institutions such as the World Bank and the International Monetary Fund. C-L: Political Science 267S. 3 units. *Ascher*

269. The Regulatory Process. The utility of contending theories of the regulatory process in explaining regulatory outcomes and of the normative explanations for regulation (for example, public goods, natural monopolies). Analysis of how regulations actually emerge from the interaction of the public, interest groups, executive, legislature, and judiciary. C-L: Political Science 268. 3 units. *Hamilton*

270S. Humanistic Perspectives on Public Policy. Modes of inquiry into aspects of social life important to policymakers but beyond the normal reach of social science. Readings from James Agee, Robert Coles, Eudora Welty, James Baldwin, George Eliot, and others. Consent of instructor required. 3 units. *Payne*

271S. Schools and Social Policy. Public schools as instruments of public policy. Economic and statistical analysis of the educational production process. Consideration of alternative school reforms. 3 units. *Clotfelter*

272L. Resource and Environmental Economics. Includes laboratory. Prerequisite: introductory course in microeconomics. See C-L: Environment 270L; also C-L: Economics 270L. 4 units. *Kramer*

274. Resource and Environmental Policy. Development of a policy analysis framework for studying resource and environmental policy. Political institutions, interest group theory, public choice theory, role of economics in policy analysis, ethics and values. Application to current and historical U.S. policy issues. Prerequisite: Environment 270L, Public Policy Studies 272, or consent of instructor. C-L: Environment 274. 3 units. *Healy and Morton*

278. Human Service Bureaucracies. Schools, prisons, courts, welfare agencies: decision making, implementation, the impact of work practices on clients. The future of street-level bureaucracy. C-L: Women's Studies. 3 units. *Malson*

283S. Congressional Policy-Making. See C-L: Political Science 283S. 3 units. *Bianco*

284S. Public Policy Process in Developing Countries. Policy-making patterns in less developed countries; examples from Latin America, Africa, and Asia. C-L: Political Science 284S. 3 units. *Ascher*

285. Land Use Principles and Policy. Consideration of four major roles of land in the United States: as a producer of commodities, financial asset, component of environmental systems, and location of development. Analysis of market allocation of land, market failure, role of public planning and regulation. C-L: Environment 285. 3 units. *Healy*

286S. Economic Policy-Making in Developing Countries. Fiscal, monetary, and exchange rate policies in less developed countries; issues in public policy toward natural resources and state-owned enterprises. Prerequisite: Economics 149 or Public Policy Studies 110. C-L: Economics 286S. 3 units. *Conrad, Gillis, or Ramachandran*

288S. Current Issues in United States Federal Tax Policy. Prerequisite: Economics 149 or consent of instructor. See C-L: Economics 288S. 3 units. *Gentry*

For Graduates

303. Public Policy Workshop I. Introduction to policy analysis and advising. Emphasis on written and oral communication skills, the substance of public policies, and the role of policy analysts. Open to Public Policy Studies M.P.P. students only. 3 units. *Staff*

304. Public Policy Workshop II. The role and influence of policy analysis. The examination of specific public policy cases and recommendations for action. Emphasis on written and oral communications skills. 3 units. *Staff*

305. Public Policy Workshop III. Emphasis on individual or group projects. Preparation for Master's Memo. Open to Public Policy Studies M.P.P. students only. 3 units. *Yaggy*

325S, 326S, A-F. Program in International Development Policy Sector Seminar. Exploration of the relationships among sectoral policies and sustainable development in less developed countries, with emphasis on a particular sector each year. Open only to Program in International Development Policy Fellows, or by consent of instructor.

- A. Urban and Rural Development in Developing Countries
 - B. Natural Resources and Environmental Policy-making
 - C. Urban Environmental Issues in Developing Countries
 - D. Restructuring the Energy Sector in Developing Countries
 - E. Privatization and the Role of the State in Development
 - F. Central American Resource and Environmental Policy
- Variable credit. *Staff*

327S, 328S, A-D. Program in International Development Policy Issue Seminar. Topics in the policy issues and institutional structures of sectoral policy-making in less developed countries. Open only to Program in International Development Policy Fellows, or by consent of instructor.

- A. Appropriate Technology and Technology Transfer
 - B. Economic Analysis of Nonrenewable Resources
 - C. Multinational Investment in Developing Countries
 - D. Technology Transfer and Foreign Aid to Developing Countries
- Variable credit. *Staff*

388. Research Tutorial in Public Policy. 3 units. *Staff*

399. Special Readings in Public Policy Studies. 3 units. *Staff*

COURSES CURRENTLY UNSCHEDULED

254. Transportation Planning and Policy Analysis

263S. Economics and International Security Policy

Religion

Professor Hillerbrand, *Chair* (123A Gray); Professor Clark, *Director of Graduate Studies* (209A Divinity School); Professors D. Campbell, Crenshaw, Hauerwas, Herzog, Kort, Langford, Lawrence, C. Meyers, E. Meyers, Osborn, Richey, E. Sanders, D. M. Smith, H. Smith, Steinmetz, Wainwright, and Wintermute; Associate Professors Bailey, Berger, Bland, Corless, Hays, Partin, Peters, Surin, and Wacker; Assistant Professors Cornell, Fulkerson, Keefe, Martin, and Turner

The Department of Religion offers graduate work in two programs leading to the A.M. and Ph.D. degrees. In Program I, students may major in one of seven fields: (1) Hebrew Bible and Semitics, (2) New Testament and Christian origins, (3) history of Christianity, (4) Christian theology and ethics, (5) history of Judaism, (6) Islamic studies and history of religions, and (7) religion, culture, and critical theory. In addition, students may apply to Program II, which permits more interdisciplinary work and more courses outside the graduate program in religion. Students will be expected to take courses which will contribute to an adequate understanding of their chosen fields of specialization and will be required to take two written preliminary examinations within their field of concentration. In addition to course work in their major field, students will take such other courses in cognate fields as will contribute to the enrichment of their major studies and will be required to take one written preliminary examination in a single cognate area within the department. A minor requirement may be fulfilled by work in a cognate department, such as classical studies, English, history, literature, philosophy, political science, or sociology, and will constitute the outside minor and material for a fourth written preliminary examination. There is, in addition, an oral examination conducted by the student's committee immediately subsequent to the written examinations. There is a foreign language requirement of two languages which must be met before taking the doctoral preliminary examination.

The program of doctoral studies presumes a foundation in the academic study of religion. Students applying for graduate work in religion directly from an undergraduate program should have had a strong undergraduate major in religion, and will be accepted for the Ph.D. program only upon the satisfactory completion of the A.M. degree with the department.

The graduate program also offers an A.M. degree that is not linked to a specific Ph.D. field. Such study is intended to encourage individuals to pursue a variety of interests irrespective of whether they desire further graduate study. An A.M. concentration may be in any of the seven Ph.D. fields or in an individually designed program of study (such as Islamic studies or religion and the social sciences).

For Seniors and Graduates

200. Person and Work of Christ. The problem of knowledge of Christ and formulation of a doctrine of his work and person in the light of biblical eschatology. 3 units. *Staff*

201. Studies in Intertestamental Literature. Selected documents of the Apocrypha and Pseudepigrapha examined exegetically and theologically in their relation to post-exilic Judaism. Consent of instructor required. 3 units. *Wintermute*

202. Language and Literature of Dead Sea Scrolls. A study in interpretation. Prerequisite: a knowledge of Hebrew. 3 units. *Wintermute*

203. Studies in American Methodism. Research seminar devoted to selected topics in the Wesleyan and Methodist traditions in America. 3 units. *Richey*

204. Origen. The systematic and apologetic writings of an important Alexandrian thinker and exegete of the third century. 3 units. *Clark*

205. War and the Christian Tradition. An analysis of how Christians have understood and evaluated war, with particular attention to the question of the moral status of war. Works by Augustine, Aquinas, Bainton, Ramsey, Childress, Niebuhr, and Johnson will be considered. 3 units. *Hauerwas*

206. The Christian Mystical Tradition in the Medieval Centuries. Reading and discussion of the writings of medieval Christian mystics (in translation). Each year will offer a special focus, such as: women at prayer; fourteenth-century mystics; and Spanish mystics. Less well-known writers as well as giants will be included. 3 units. *Keefe*

207, 208. Readings from the Hebrew Bible. Grammar with rapid reading of selected passages, both prose and poetry. Prerequisite: at least one year of Hebrew or consent of instructor. 3 units each. *Staff*

209. Old Testament Theology. Studies of the Old Testament in regard to theological themes and content. 3 units. *Crenshaw*

211. Authority in Theology. The idea and function of authority in theology. 3 units. *Fulkerson*

212. Religion: Interpretations and Perspectives. Approaches and methods used for studying religion. Emphasis on the description, explanation, and analysis of such concepts as religion, religious experience, and religious practice. 3 units. *Staff*

213. Christian Ethics in America. Ethical thought in America since Rauschenbush. 3 units. *Hauerwas*

214. Feminist Theology. Examination of feminist theologians and religionists, their critical perspective on the Christian tradition and constructive proposals out of the resources of "female experience." 3 units. *Fulkerson*

216. Syriac. The script and grammar, with readings from the Syriac New Testament and other early Christian documents. Prerequisites: some knowledge of Hebrew and Aramaic. 3 units. *Wintermute*

217. Islam in India. History and thought of major Indian Muslims from Biruni to Wali-Ullah, with special attention to the role of Sufism. An introduction to selected Muslim scholars and saints who contributed to the interaction between Islam and Hinduism in northern India during the second millennium A.D. 3 units. *Lawrence*

218. Religions of East Asia. Shinto, Taoism, Confucianism, and East Asian Buddhism studied phenomenologically in relation to the Axial Age. 3 units. *Corless*

219. Augustine. The religion of the Bishop of Hippo in late antiquity. C-L: Medieval and Renaissance Studies. 3 units. *Clark*

220. Rabbinic Hebrew. Interpretive study of late Hebrew, with readings from the Mishnah and Jewish liturgy. 3 units. *E. Meyers or staff*

221. Readings in Hebrew Biblical Commentaries. Selected Hebrew texts in Midrash Aggadah and other Hebrew commentaries reflecting major trends of classical Jewish exegesis. 3 units. *Bland*

222. John among the Gospels. A consideration of the character, content, and purpose of the Gospel of John in relation to the synoptic and apocryphal gospels. Prerequisite: one year of Hellenistic Greek. 3 units. *M. Smith*

223. A-E. Exegesis of the Hebrew Old Testament.

- A. Pentateuch
 - B. Historical Books
 - C. Major Prophets
 - D. Minor Prophets
 - E. Writings
- 3 units. *Staff*

224A. Comparative Semitic I. An introduction to the morphology and syntax of classical Ethiopic and the Semitic languages of Mesopotamia, together with a consideration of their relationships to Hebrew. 3 units. *Wintermute*

224B. Comparative Semitic II. An introduction to the morphology and syntax of classical Arabic and the Semitic languages of Palestine-Syria, together with a consideration of their relationships to Hebrew. 3 units. *Wintermute*

225. Living Issues in New Testament Theology. Critical examination of major problems and issues in New Testament interpretation and theology. 3 units. *Staff*

226. A-F. Exegesis of the Greek New Testament I.

- A. Matthew
 - B. Romans
 - C. Mark
 - E. The Gospel and Epistles of John
 - F. I and II Corinthians
- 3 units. *D. M. Smith or staff*

227. A-E. Exegesis of the Greek New Testament II.

- A. Luke
 - B. Galatians
 - C. The Pastoral Epistles
 - D. Epistles of Peter and James
 - E. Acts
- 3 units. *D. M. Smith or staff*

227F. Exegesis of the Greek New Testament II: The Synoptic Gospels. Concentration on the "classical" methods of studying the synoptic gospels: source criticism, form criticism, and redaction criticism. Students expected to become proficient in using the Greek synopsis. Prerequisite: two years of Greek or the equivalent. 3 units. *Sanders*

228. Twentieth-Century Continental Theology. An investigation of leading theologians and theological trends. 3 units. *Osborn*

231S. Seminar in Religion and Contemporary Thought. Analytical reading and discussion of such critical cultural analysis as is found in the works of Polanyi, Arendt, Trilling, and others, with appraisal of the relevance of theological inquiry. 3 units. *Staff*

232S. Religion and Literary Studies. Theories concerning the relation of religion to literary forms, particularly narrative. 3 units. *Kort*

233. Modern Narratives and Religious Meanings. A study of kinds of religious meaning or significance in representative American, British, and continental fiction of the first half of the twentieth century. 3 units. *Kort*

234. Early Christian Asceticism. The development of asceticism and monasticism in the first six centuries of Christianity. C-L: Women's Studies. 3 units. *Clark*

235. Heresy: Theological and Social Dimensions of Early Christian Dissent. 3 units. *Clark*

236. Luther and the Reformation in Germany. The theology of Martin Luther in the context of competing visions of reform. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*

237. History of the Ancient Near East. Emphasis upon the religions, literature, and art of Mesopotamia. 3 units. *Bailey*

239. Introduction to Middle Egyptian I. Grammar and readings in hieroglyphic texts relating to the Old Testament. 3 units. *Wintermute*

240. Introduction to Middle Egyptian II. Readings in Middle Egyptian and introduction to New Egyptian grammar. Prerequisite: Religion 239. 3 units. *Wintermute*

243. Archaeology of Palestine in Biblical Times. Investigation of selected material remains from the Bronze Age to the Persian period. Trends in biblical studies, with particular attention to methodological considerations and current developments. 3 units. *C. Meyers*

244. Archaeology of Palestine in Hellenistic-Roman Times. The study of material and epigraphic remains as they relate to Judaism in Hellenistic-Roman times, with special emphasis on Jewish art. 3 units. *E. Meyers*

247. Readings in Latin Ecclesiastical Literature. Readings in Latin of pastoral, theological, and church-disciplinary literature from the late patristic and medieval period. Prerequisite: knowledge of Latin. 3 units. *Keefe*

248. Theology of Karl Barth. A historical and critical study of Barth's theology. 3 units. *Osborn*

250. Women in the Medieval Church. The history of the Medieval Church told from its women figures: the life and writings of saints, heretics, abbesses, queens, mystics, recluses, virgins, bishops' wives, and reformers. 3 units. *Keefe*

253. Feminist Theory and the Study of Christianity. Nineteenth- and twentieth-century feminist theories and their implications for Christian doctrine and biblical interpretation. C-L: Women's Studies. 3 units. *Clark and McClintock-Fulkerson*

255. Christians in Religious Dialogue. An examination, from within Christian theology, of the principles of dialogue; of various contemporary dialogues with Jews, Muslims, Hindus, and Buddhists; and of traditional and emergent theologies of religion. 3 units. *Wainwright*

257. New Testament Ethics. Scope and basic problems of New Testament ethics; consideration of two important New Testament books. Problems and issues such as the role of the law, symbolic language in ethical discourse, conscience, homosexuality, the state, and self deception. 3 units. *Hays*

258. Coptic. Introduction to the Sahidic dialect with selected readings from Christian and Gnostic texts. Prerequisite: one year of Greek or consent of instructor. 3 units. *Wintermute*

260. Life and Times of the Wesleys. A seminar on John and Charles Wesley and their colleagues in relation to English culture and religion in the eighteenth century. 3 units. *Staff*

261. Islam in the African-American Experience. The impact of Islam on the religious experiences of African Americans. 3 units. *Staff*

263. Third World Theology. An examination of selected theological writings from Asia, Africa, and Latin America, comparing their perspectives and their unique contributions with contemporary Christian thought. 3 units. *Staff*

264. The Sociology of the Black Church. An effort to identify, define, describe, and interpret the black church. 3 units. *Staff*

266. Ethics and Health Care. 3 units. *H. Smith*

267. American Religious Thought. Examination of selected classic studies of American religious thought. 3 units. *Richey and Wacker*

268. Revelation and Authority in the Church. A critical and constructive examination of contemporary concepts. 3 units. *H. Smith*

270. American Evangelicalism and Fundamentalism. A study of some of the major themes in the development of transdenominational evangelicalism and fundamentalism in America from the eighteenth century to the present. This will be a reading seminar involving analyses and discussions of literature (mostly secondary works) important for understanding American evangelicalism as a distinct movement. 3 units. *Wacker*

271. Christologies of the Early Church. Investigation of important soteriologies and debates centering upon the person of Christ from the second through the fifth centuries. 3 units. *Staff*

272, A-B. The Early Medieval Church.

A. Selected Readings in Early Medieval Religious Studies

B. Social History of the Church in Europe.

Prerequisite: knowledge of Latin. 3 units. *Keefe*

273. Continental and British Roots of Evangelicalism. Introduction to a range of religious phenomena in Europe and Britain in the late seventeenth and eighteenth centuries characterized by a stress on personal religious experience. Movements studied will include Jansenism, quietism, radical movements of the English Revolution, pietistic puritanism, precisianism, reformed and Lutheran pietism, and the evangelical revival in Wales and England. 3 units. *Staff*

274A. Philosophies, Sciences, and Theologies of the European Enlightenment: Descartes to Kant. Western theological thought since the Scientific Revolution, with emphasis on developments and movements that occurred in the seventeenth and eighteenth centuries. Descartes, Locke, Leibniz, Spinoza, Hume, Vico, Lessing, Herder, and Kant. 3 units. *Surin*

275S. Topics in Early Christian and Byzantine Art. Consent of instructor required. See C-L: Art 233S; also C-L: Classical Studies 230S and Medieval and Renaissance Studies. 3 units. *Wharton*

276. The Sacraments in the Patristic and Early Medieval Period. A study of the celebration and interpretation of baptism or eucharist in the church orders and texts of the early church writers. 3 units. *Keefe*

277. Judaism in the Greco-Roman World. History, religion, and literature of the Jews in Palestine from 200 B.C.E. to 66 C.E. Not open to students who have taken Religion 137. Prerequisite: one year of Greek. 3 units. *Sanders*

280. The History of the History of Religions. The origin and history of the comparative study of religion, with particular attention to its methodology. 3 units. *Partin*

284. The Religion and History of Islam. Origins and development of the Islamic community and tradition, with particular attention to the religious element. 3 units. *Cornell, Lawrence, or Partin*

286. The Second Vatican Council (1962-1965). A theological introduction to the Second Vatican Council, offering the opportunity to reflect on some of the fundamental aspects of the nature and identity of the Roman Catholic Church. 3 units. *Berger*

292. Happiness, Virtue, and Friendship. Issues of their relationship in moral philosophy. 3 units. *Hauerwas*

293. Religious Issues in American History. A reading seminar devoted to selected topics, problems, and issues in American religion. 3 units. *Richey and Wacker*

293A. Christianity and American Thought. A study of major issues and of the thought of some major persons since the time of the Revolution, with attention to the underlying assumptions of Christian and other American thought. 3 units. *Richey and Wacker*

294. Christianity and American Society. Consideration of civil religion, church and state, the Protestant establishment and secularization in their historical development and contemporary expressions in America. 3 units. *Richey*

296. Community, Faith, and Violence. This seminar explores attempts to formulate fundamentally theological modes of social and political criticism with the focus on the role of faith and violence in secular society. Readings include works by theologians, social critics, and political theorists. 3 units. *Staff*

297. Philosophical and Theological Discourses on Modernity. Theological responses to the intellectual and cultural agendas set by the Enlightenment. 3 units. *Surin*

298. Religious Pluralism and Christian Theologies. The ascription of superiority or uniqueness to particular religions within the context of the world religions. The phenomenon of religious pluralism will provide a thematic focus for this study. 3 units. *Surin*

For Graduates

300. Systematic Theology. Method and structure of systematic theology, the doctrine of God, theological anthropology, and Christology. 3 units. *Herzog*

303. The Old Testament in the New: New Testament Writers as Interpreters of Scriptures. This doctoral seminar examines the ways in which New Testament authors read and interpreted Scripture. Working knowledge of Greek and Hebrew required. 3 units. *Hays*

304. Aramaic. A study of the Aramaic portions of the Old Testament and selected passages from the Elephantine and Qumran texts. 3 units. *E. Meyers or Wintermute*

305. The Septuagint. A study of the modern critical use of the Greek Old Testament. Prerequisites: knowledge of Greek and Hebrew. 3 units. *Peters*

309. Hermeneutics. Consideration of the nature of understanding and of several interpretive methods—such as phenomenological, existential, historical, literary, structural—along with their application to New Testament texts, primarily the parables of Jesus. 3 units. *Staff*

310. Readings in Judaica. Selected studies in Jewish material culture and problems in Jewish religious and intellectual history. 3 units. *Bland, E. Meyers, and staff*

311. Pharisaic Judaism in the First Century. A reading course in first-century Pharisaic Judaism. 3 units. *Sanders*

312. Pauline Theology. Studies in some aspects of Paulinism in the light of recent scholarship. 3 units. *Sanders*

313. The Apostolic Fathers. A study of the religious thought in the writings of the Apostolic fathers. 3 units. *Staff*

315A. Problems in the Study of Paul. Justification and the law in light of the chronology of the letters. A series of advanced seminars that combine study of a theological issue with an analysis of a nontheological problem (literary, historical, social). Prerequisite: at least one Greek exegesis course in the Pauline letters. 3 units. *Sanders*

320. Theology, Power, and Justice. Critical examination of a major theme of modern Protestant thought in Hegel, Marx, Schleiermacher, and Tillich. 3 units. *Herzog*

321. The Theology of Paul: Structure and Coherence. Review of recent critical discussion of Pauline theology, with particular emphasis on the problem of the structure and coherence of Paul's thought. Reading knowledge of German, as well as some previous work in Greek exegesis of the Pauline corpus is required. 3 units. *Hays*

322. Nineteenth-Century European Theology. Protestant theology from Kant to Herrmann. 3 units. *Herzog*

329. Readings in Theology and Language. Sample treatments of religious language in linguistic analysis, hermeneutical theory, literary criticism, liturgical practice, and fundamental theology. 3 units. *Wainwright*

330. Contemporary Christologies. A seminar dealing with contemporary Roman Catholic and Protestant Christology. Readings and discussion will focus on theological proposals from major contemporary figures. 3 units. *Wainwright*

332. System in Theology. An examination of the various factors that go into the shaping of a systematic theology, followed by a study of several recent and contemporary examples of the genre. 3 units. *Wainwright*

333. The Doctrine of the Trinity. Biblical bases, patristic developments, contemporary statements and connections. 3 units. *Wainwright*

335. The English Church in the Eighteenth Century. Studies of Christianity in England from the Act of Toleration, 1689, to the death of John Wesley, 1791. 3 units. *Staff*

336. Worlds and Texts. Focus on specific works in theological method which deal, whether directly or indirectly, with the question of the affiliations between texts and their mediating social and historical realities. 3 units. *Surin*

337. Theology of St. Thomas Aquinas. Intensive reading of the *Summa Theologica* and biblical commentaries. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*

338. Calvin and the Reformed Tradition. The theological development of John Calvin. A comprehensive examination of his mature position with constant reference to the theology of other reformers. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*

339. The Radical Reformation. Protestant movements of dissent in the sixteenth century. Special attention will be devoted to Müntzer, Carlstadt, Hubmaier, Schwenckfeld, Denck, Marpeck, Socinus, and Menno Simons. C-L: Medieval and Renaissance Studies. 3 units. *Steinmetz*

340, 341. Seminar in the New Testament. Research and discussion on a selected problem in the biblical field. Spring only. 3 units each. *Staff*

345. Catholic Moral Theology: Its History and Contemporary Issues. The development of Catholic social and moral theory from a historical and analytical perspective. Study of the Catholic social encyclicals as well as the casuistical tradition. Reading of works by Rahner, Haering, Fuchs, Schuller, McCormick, and Curran. 3 units. *Hauerwas*

347. Hebrew Narrative Art. Analysis of the literary craft of selected biblical narratives, and critique of various approaches to studying the art of Hebrew narrative. Prerequisites: knowledge of Hebrew and consent of instructor. 3 units. *Crenshaw*

348. Seminar in Theological Ethics. Philosophical paradigms and the nature of the Christian life. 3 units. *Hauerwas*

349. History and Historiography of Religion in North America. An opportunity for advanced students in North American religious studies to deepen their understanding of some of the major questions in the field. Examination of how religious history is actually written—with special attention to the imaginative and moral motivations that enter into that process. 3 units. *Wacker*

350, 351. Old Testament Seminar. Research and discussion on selected problems in the Old Testament and related fields. Fall only. 3 units each. *Staff*

352. Seminar in Christian Theology. Research and discussion of a selected problem in the systematic field. 3 units. *Staff*

353. Seminar on Text Criticism. Emphasis upon transmission, versions, apparatus, and method. Prerequisites: reading knowledge of Hebrew and Greek. 3 units. *Bailey*

360. Special Problems in Religion and Culture. Intensive investigation of the relations of religion and modernity, using seminal contemporary texts. Topics announced each semester. Consent of instructor required. 3 units. *Staff*

362. Readings in Old Testament and Semitic Studies. Selected studies in the Hebrew Bible and the languages and literatures of the ancient Near East. 3 units. *Staff*

363. Readings in New Testament and Christian Origins. Selected studies on a theme in modern New Testament scholarship. 3 units. *Staff*

364. Readings in History of Christianity. Selected issues in the social, material, and intellectual history of Christianity. 3 units. *Staff*

365. Readings in Christian Theology and Ethics. An examination of selected topics of historical and contemporary interest in these fields. 3 units. *Staff*

366. Readings in History of Religions. Selected studies in cross-cultural and intercreedal material, together with assessment of the problems they pose for the study of religion. 3 units. *Staff*

367. Readings in Religion and Culture. Analysis and discussion of theories and of individual research projects. 3 units. *Staff*

383. Moral Theology in the Twentieth Century. Critical and comparative examination of ethical theory as exhibited in the work of selected contemporary theologians. 3 units. *H. Smith*

387. Ethical Method. Selected methodological issues in contemporary theological ethics. 3 units. *H. Smith*

388. Ethics and Medicine. A critical study of selected aspects of modern biomedical technology, with special reference to the ethical assumptions informing their development and practice. 3 units. *H. Smith*

397. Readings in North American Religious History. Directed research on selected topics in the history of religion in the United States and Canada. 3 units. *Wacker*

COURSES CURRENTLY UNSCHEDULED

210. Contemporary British Theology

230S. The Meaning of Religious Language

238. Jewish Responses to Christianity

241. Problems in Reformation Theology

242. Life after Death in Semitic Thought

245. Ethics in World Religions

246. Problems in Historical Theology

249. The Lord's Prayer

251. Counter-Reformation and Development of Catholic Dogma

252. Nineteenth- and Twentieth-Century Roman Catholic Theology

256. John Wesley in Controversial and Ecumenical Theology

259. Icon Theology

262. Marxist Ideology and Christian Faith

269S. Feminist Theory and the Humanities

274B. Philosophies, Sciences, and Theologies after the European Enlightenment: Schleiermacher to Troeltsch

279. Understandings of the Resurrection in Contemporary Thought

281. Phenomenology and Religion

282. Myth and Ritual

283. Islam and Modernism

285. Introduction to the History of Religions

287. The Scriptures of Asia

288. Buddhist Thought and Practice

289. Theology and Contemporary Secular Understanding of Human Nature

290. Current Problems in Christian Social Ethics

291. Historical Forms of Protestant Ethics

295. Religion in the American South

299. The Christian Understanding of Human Nature and Destiny

301. Seminar in Contemporary Christian Ethics

304A. Targumic Aramaic

- 308. Greek Patristic Texts
- 314. Judaism and Christianity in the New Testament
- 316S. History of Religions
- 317. Seminar in the Greek Apologists
- 318. Seminar in the Greek Fathers
- 319. The Gospel According to Saint Matthew in Recent Research
- 324. Readings in the History of Religion
- 325. Philosophical Theology I
- 326. Philosophical Theology II
- 327. Philosophical Method in Religious Studies
- 328. Twentieth-Century European Theology
- 331. Eschatology
- 334. Theology and Reform in the Later Middle Ages
- 342. American Religious Biography
- 343. Readings in Ancient Near Eastern Wisdom Literature
- 344. Zwingli and the Origins of Reformed Theology
- 346. Practical Reason and Personal Identity: Explorations in Narrative
- 373-374. Elementary Akkadian
- 380. Existentialist Thought
- 386. Christianity in Dialogue with Other Faiths
- 389. Christian Ethics and Contemporary Culture
- 398. Colloquium on the Teaching of Religion
- 401. Colloquium on Biblical Studies

Romance Studies

Professor Thomas, *Chair* (205 Languages); Professor Stewart, *Director of Graduate Studies* (205 Languages); Professors Caserta, Garci-Gómez, Jameson, Mudimbe, Orr, Osuna, Pérez Firmat, Schor, and Tetel; Associate Professors Bell, Hull, Kaplan, Mignolo, Moi, Mudimbe-Boyi, and Sieburth; Assistant Professors Farrell, Finucci, Ross, Solterer, and Vilarós; Adjunct Associate Professor Keineg; Associate Professor of the Practice and Director of Language Programs Tufts; Research Professor Dorfman; Visiting Assistant Professor Moreiras

The Department of Romance Studies offers graduate work leading to the Ph.D. degree in French and Spanish. Related work is required in a second Romance language or in any one or two of a number of other subject areas. A reading knowledge of one foreign language which is outside the major language is required. In order to undertake graduate study in Romance languages, the entering student should have credit for at least 18 semester hours (or equivalent) above the intermediate level in the major language.

FRENCH

For Seniors and Graduates

200S. Seminar in French Literature. Topics to be announced. 3 units. *Staff*

210. The Structure of French. Modern French phonology, morphology, and syntax. Readings in current linguistic theory. 3 units. *Thomas*

211. History of the French Language. The evolution of French from Latin to its present form; internal developments and external influences. C-L: Medieval and Renaissance Studies. 3 units. *Thomas*

223. Semiotics for Literature. Theoretical writings in general semiotics by Frege, Peirce, Saussure, Mukarovsky, and Morris and their applications for textual analysis of French literary works by representative contemporary critics such as Eco, Riffaterre, Corti, and Greimas. Taught in English. C-L: Literature 280. 3 units. *Thomas*

256. Modern Literature and History. The problems of history, society, and politics in literature, through the writings of Rousseau, Tocqueville, Michelet, Flaubert, Hugo, Merleau-Ponty, Foucault, and others. C-L: History 256. 3 units. *Orr*

258. The Narrative of Social Crisis. Realism and naturalism, with special emphasis on Balzac, Flaubert, and Zola. 3 units. *Bell, Jameson, Orr, or Schor*

261. French Symbolism. Poetry and theories of Baudelaire, Mallarmé, and Rimbaud. Decadence: Lautréamont and Laforgue. 3 units. *Thomas*

264. Contemporary French Poetry. The language of poetry. A chronological and theoretical approach to the major poets and movements since 1950. Selections from Bonnefoy, Char, Daive, Deguy, Dupin, Jabès, Jaccottet, Faye, Guillevic, Michaux, Meschonnic, Noël, Oulipo, Ponge, Stefan, Tortel, and others. 3 units. *Orr or Thomas*

265. French Literature of the Early Twentieth Century. Emphasis on Gide, Mauriac, Proust, and Colette. 3 units. *Kaplan*

266. French Literature of the Mid-Twentieth Century. Emphasis on Malraux, Sartre, Camus, and the *nouveau roman*. 3 units. *Jameson*

281. Paradigms of Modern Thought. An introduction to contemporary French philosophy with a focus on the notions of identity and difference, the human origin of truth and the question of enunciation. French majors and French graduate students must do course work in French. 3 units. *Mudimbe*

For Graduates

300. Graduate Reading Course. An intensive course in French to develop rapidly the ability to read French in several fields. Graduate students only. No credit. *Staff*

325. Topics in Renaissance Prose. Rabelais, Marguerite de Navarre, Montaigne, and others. C-L: Medieval and Renaissance Studies. 3 units. *Tetel*

326. Topics in Renaissance Poetry. C-L: Medieval and Renaissance Studies. 3 units. *Tetel*

348. French Literature of the Seventeenth Century. The baroque and the classical: form and meaning in the plays of Corneille, Racine, and Molière. Readings in baroque and précieux poetry. C-L: Medieval and Renaissance Studies. 3 units. *Farrell*

351, 352. Literature of the Eighteenth Century. Problems of literary history, critical reading, and interpretation, focused on varying topics. 3 units each. *Stewart*

355. French Preromantic and Romantic Poetry. Chénier, Vigny, Lamartine, Musset, Hugy, and Nerval. 3 units. *Orr*

367. Contemporary French Novel. A chronological and theoretical approach to the major writers and movements since 1970. Selections from Duras, LeClézio, Sallenave, Modiano, Sollers, Tournier, Oulipo, Yourcenar, and others. 3 units. *Kaplan, Orr, or Thomas*

368. Structuralism. An introduction to contemporary French philosophy with a focus on the notions of identity and difference, the human origin of truth and the question of enunciation. The work of Claude Lévi-Strauss or Michel Foucault will be considered as a paradigm. Additional readings might include chapters from Georges Canguilhem, Vincent Descombes, Jean Hyppolite, Alexandre Kojève, Maurice Merleau-Ponty, and Elliott Valenstein. 3 units. *Mudimbe*

370. Topics in French and Francophone Literature. Concentration on twentieth-century literature. Historical and theoretical approach. Varying topics. Readings include literary and nonliterary texts. 3 units. *Keineg or Mudimbe-Boyi*

381. Special Topics Tutorial. Directed reading and research in areas unrepresented by regular course offerings. 3 units. *Staff*

391, 392. French Seminar. C-L: Medieval and Renaissance Studies. 3 units each. *Graduate faculty*

Courses Currently Unscheduled

240. Old French Literature

257. Problems of Identity in the Nineteenth-Century Novel

263. Contemporary French Theater

290S. Studies in a Contemporary Figure

ITALIAN

For Seniors and Graduates

283. Italian Novel of the Novecento. Representative novelists from Svevo to the most recent writers. 3 units. *Caserta*

284, 285. Dante. 284: *La Vita Nuova* and a close reading of the *Inferno*. 285: *The Purgatorio* and the *Paradiso* in the light of Dante's cultural world. Special attention will be given to the poetic significance of the *Commedia*. Reading in Italian or English. Prerequisite: for 285, Italian 284 or equivalent. C-L: Medieval and Renaissance Studies. 3 units each. *Caserta*

PORTUGUESE

For Graduates

200S. Seminar in Portuguese Literature. Topics to be announced. 3 units. *Staff*

202. Topics in Portuguese and Brazilian Literature and Culture. 3 units. *Staff*

SPANISH

For Seniors and Graduates

200S. Seminar in Spanish Literature. Topics to be announced. 3 units. *Staff*

210. History of the Spanish Language. Formation and development. Internal forces and external contributions. C-L: Medieval and Renaissance Studies. 3 units. *Garci-Gómez*

245. Modern Spanish-American Poetry. From modernismo to the present. 3 units. *Staff*

248. Studies in Spanish-American Literature. Concentration on single authors, genres, movements, or themes. 3 units. *Staff*

275. Modern Spanish Poetry. Juan Ramón Jiménez, Unamuno, Antonio Machado, the Generation of 1927, and the contemporary poets. 3 units. *Osuna*

For Graduates

341. Colonial Prose of Spanish America. Narrative forms written in Spanish America during the sixteenth, seventeenth, and eighteenth centuries. 3 units. *Ross*

342. Colonial Poetry and Theater of Spanish America. The expression of Renaissance and Baroque styles in the Hispanic New World, including works of Sor Juana, Ruiz de Alarcón, Errilla, and others. 3 units. *Ross*

344. Philosophy, Cultural History, and Literature in Latin America. Special topics. 3 units. *Mignolo*

346. Modern Spanish-American Fiction. Twentieth-century novels and short stories by Borges, Carpentier, Cortázar, Gallegos, García Márquez, Quiroga, and others. 3 units. *Pérez Firmat*

351. The Origins of Spanish Prose Fiction. Selected examples of the romance and the novel: *Amadís de Gaula*, Diego de San Pedro's *La Cárcel de amor*, the *Abencerraje*, the *Lazarillo*, Montemajor's *Diana*. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

353. Cervantes. The life and works of Cervantes, with special emphasis on his *Quijote*. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

354. Drama of the Golden Age. The chief Spanish dramatists of the seventeenth century with readings of representative plays of this period. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

358. Spanish Lyric Poetry before 1700. A critical study, based on close reading and discussion, of selected poems of the Middle Ages, Renaissance, and baroque. Special emphasis on the *Razón de amor*, *la Poesía de tipo tradicional*, and Santillana; on Garcilaso, San Juan de la Cruz, Fray Luis de León, and Herrera; on Góngora and Quevedo. C-L: Medieval and Renaissance Studies. 3 units. *Staff*

366. Nineteenth-Century Prose Fiction. Readings by novelists such as Valera, Galdós, Alas, and Pardo Bazán in the light of current critical theory. 3 units. *Sieburth*

370. Spanish Texts of the Post-Dictatorship: 1975 to Present. An analysis of some artistic and popular productions that came to light in Spain after Franco's death in 1975. Focus on literary and cinematic texts and other cultural productions such as music and comics. 3 units. *Vilarós*

391, 392. Hispanic Seminar. Each semester one of the following topics will be selected for intensive treatment: the Spanish language in America, studies in medieval literature, studies in the literature of the Golden Age, studies in Latin American literature, studies in the Spanish Renaissance and baroque, studies in Spanish poetry, studies in nineteenth-century Spanish literature, and studies in twentieth-century literature. C-L: Medieval and Renaissance Studies. 3 units each. *Staff*

Courses Currently Unscheduled

262. The Romantic Movement

276. Modern Spanish Drama

277. Modern Spanish Novel

ROMANCE STUDIES

306. Theories and Techniques of Teaching Foreign Languages. A survey of approaches to foreign language teaching, an introduction to the theoretical notions underlying current trends, and a language-specific practicum. 3 units. *Tufts*

310. Critical Frameworks. An introduction to critical theory through a series of interconnected readings organized around a major theoretical approach or issue. 3 units. *Staff*

Courses Currently Unscheduled

218. The Teaching of Romance Languages

Slavic Languages and Literatures

Associate Professor Lahusen, *Chair*; Assistant Professor Gheith, *Director of Graduate Studies*; Associate Professors Andrews, Dobrenko, and Pugh; Associate Professor Emeritus Jezierski; Adjunct Associate Professor Pelech; Assistant Professors of the Practice Dolgova, Flath, Maksimova, and Van Tuyt

The Department of Slavic Languages and Literatures offers graduate work leading to the A.M. and Ph.D. degrees in Russian literature and Slavic linguistics. Entering students should have had sufficient undergraduate courses in the Russian language to enable them to proceed to more advanced work. Requirements for the A.M. degree may be met by completion of course work and by passing a comprehensive exam. Reading knowledge of French or German is required for both concentrations. All students must demonstrate advanced knowledge of the Russian language. The A.M. program is expected to take one to two years for completion. Candidates for the Ph.D. degree must have received an A.M. degree at Duke or be able to demonstrate that their previous studies qualify as an equivalent to the A.M. degree offered by Duke. Individual programs of study are developed for each student but all students in Russian literature must demonstrate extensive knowledge of Russian literature, competence in another Slavic literature (or, in special circumstances, in a non-Slavic literature), and in literary theory. Literature students must exhibit competence in at least one other Slavic language from the West or South Slavic area. Students in Slavic linguistics must demonstrate competence in Russian and Slavic diachronic and synchronic linguistics, and in general linguistic theory. Linguistics students must demonstrate knowledge of one Slavic language from the West and one from the South Slavic area, in addition to Russian. Knowledge of these areas will be determined through the preliminary examination. Following successful completion of the preliminary examination, students will be expected to write and defend a dissertation based on original research. All Ph.D. candidates are required to teach at least one full academic year as teaching experience is essential in completing one's professional training.

Further information about the graduate programs, including specific requirements, can be obtained from the director of graduate studies.

RUSSIAN

For Seniors and Graduates

201S. Topics in Comparative Slavic Linguistics. A cycle of survey courses on the phonology, morphology, and dialects of the Slavic languages. Taught in English. Readings in Russian.

A. East Slavic

- B. West Slavic
- C. South Slavic
- D. Common Slavic
- 3 units. *Andrews or Pugh*

203S. Old Church Slavonic. Introduction to the language of the earliest Slavic texts. Close study of phonological and morphological systems, reading of texts and discussion. Taught in English. C-L: Religion 229S. 3 units. *Pugh*

204S. Russian Folklore and Popular Culture. Work songs and ritual songs, lamentations, riddles, and proverbs. Tales and later forms of popular creation (chastushki, anecdotes, urban romance) and their function in Russian culture. Taught in Russian. 3 units. *Dolgova*

205. Semiotics and Linguistics. A survey of modern semiotics, particularly the works of C. S. Peirce and Umberto Eco. Semiotic works directly related to modern linguistic thought and linguistic sign theory. Emphasis on the interdisciplinary aspects of semiotic theory. C-L: English 205. 3 units. *Andrews (Slavic)*

207S. Semantics. Survey of modern semantic theory, including a range of theoretical approaches: communication theory, structuralism, markedness, and generative semantics. Emphasis on lexical meaning and deictic relations. Taught in English. 3 units. *Andrews*

208. Stylistic and Compositional Elements of Scholarly Russian. Introduction to Russian texts and terminology including business, economics, law, history, political sciences, psychology, linguistics, and literary criticism. Prerequisite: Russian 64 or consent of instructor. 3 units. *Maksimova*

210. Literature and Criticism of Socialist Realism. The genesis and development of Soviet socialist realism. A survey of Soviet literary theories from Lunacharsky to Ovcharenko, and contemporary Western criticism (for example, K. Clark, R. Robin). A critical approach to the dialogic alternative to monologic literature through literary illustration (selected Soviet literary works from the 1930s to the present day). Taught in English. 3 units. *Lahusen*

230. Soviet Cinema. History of Soviet film industry from silent to sound period. Overview of major theorist-filmmakers: Eisenstein, Pudovkin, Vertov. Issues of reception, audience, politics, form, national and ethnic identities. Taught in English. 3 units. *Gaines, Jameson, and Lahusen*

240S. Russian Literary Discourse. Nineteenth- and twentieth-century Russian literary theory, with close readings in the original. Application to fiction. Taught in English. 3 units. *Lahusen*

250. Trends in Russian and East European Literary Criticism and Beyond. The major critical movements in the nineteenth and twentieth centuries in Russia, East-Central Europe, and the West. Authors and theories include the Belinsky school, formalism, Bakhtin, structuralism, semiotics, and psychoanalytic and feminist theory. Taught in English. 3 units. *Gheith*

261, 262. Nineteenth-Century Russian Literature. Selected nineteenth-century authors, works, and genres. Authors include Pushkin, Lermontov, Gogol, Turgenev, Dostoevsky, Tolstoy, and Chekhov. Taught in English. Readings in Russian. 3 units each. *Staff*

265S. Literature of Early Russia. Works from the eleventh to the seventeenth centuries, including Ilarion's *Sermon on Law and Grace*, *The Tale of Bygone Years*, *The Igor Tale*, *Domostroi*, *Avvakum's Life*. Readings in Russian. 3 units. *Dolgova and staff*

266S. The Sources of Modern Russian Literature: The Eighteenth Century. Development of the major forms of Russian literature, including verse, drama, and the beginnings of the prose tradition. Authors include Kantemir, Lomonosov, Sumarokov, Trediakovsky, Fonvizin, Derzhavin, and Karamzin. Readings in Russian. 3 units. *Gheith*

269. Women and Russian Literature. Women authors in Russia from the eighteenth century to the present: their works and lives. The role that works by women have played in Russian literature and culture. The question of whether women's writing in Russia constitutes a tradition. Authors include Dashkova, Catherine the Great, Kovalevskaia, Kollontai, Chukovskaia, Akhmatova, Petrushevskia, and Tolstaia. Taught in English. Readings in Russian. C-L: Women's Studies. 3 units. *Gheith*

272S. Pushkin and His Time. Pushkin and the literary revolution around 1830. Prose works (*The Tales of Belkin*, *The Queen of Spades*, *The Captain's Daughter*) and major lyrical poetry. Taught in English. Readings in Russian. 3 units. *Gheith or Van Tuyl*

273S. Gogol. Life, works, and criticism. Readings include *Dead Souls*, *The Inspector General*, *Petersburg Tales*, and other short fiction. Readings in Russian. 3 units. *Lahusen*

275. Tolstoy. Introduction to life, works, and criticism. Readings include: *War and Peace*, *Anna Karenina*, the shorter fiction, dramatic works and essays. Taught in English. Readings in Russian. 3 units. *Van Tuyl*

276. Dostoevsky. Introduction to life, works, and criticism. Readings include: *Crime and Punishment*, *The Idiot*, and *The Brothers Karamazov*. Taught in English. Readings in Russian. 3 units. *Flath, Gheith, or Van Tuyl*

277S. Chekhov. Drama and prose works. Readings in Russian. 3 units. *Flath*

278. Leskov. His works, criticism, and life in the context of the literary culture of late nineteenth-century Russia. Works include: "The Lefthander," "Lady Macbeth of the Mtsensk District," "The Toupee Artist," "A Little Mistake," and "Night Owls." 3 units. *Gheith*

279S. Literature of the Former Soviet Republics. Ukrainian realism of the nineteenth century, futurism, neoclassicism, and the literary struggle of the 1920s; Belorussian literature; Lithuanian psychological prose; the Estonian experimental novel; Georgian literature from Rustaveli to the philosophical novel of the 1970s; the work of Chingiz Aitmatov; Soviet "recent literacy." Taught in Russian. 3 units. *Dobrenko*

280. Early Twentieth-Century Russian Literature: From Symbolism to the 1920s. Symbolism, acmeism, futurism, imagism, proletarian literature. Authors include Bely, Sologub, Bryusov, Blok, Vyacheslav Ivanov, Khodasevich, Akhmatova, Mandelshtam, Mayakovsky, Khlebnikov, Gorky, Bogdanov, Gastev. Readings in Russian. 3 units. *Lahusen*

281. The 1920s: The Road to a New Synthesis. The literary struggle of the 1920s; proletarian literature from the Smithy to RAPP, LEF and the fate of the avant-garde, the aesthetic conception of Pereval, the literature of the absurd, Oberiu and the Serapion Brothers. Authors include Kirillov, Gladkov, Babel, Pilnyak, Olesha, Zamyatin, Platonov, Kharms, and Pasternak. Readings in Russian. 3 units. *Dobrenko or Lahusen*

282. Socialist Realism: Soviet Literature of the 1930s and 1940s. The Stalin era of Russian literature, the genesis and development of socialist realism, Soviet literature and the theme of boundaries and war. Authors include Sholokhov, Ostrovsky, Fadeev, Azhaev, Babaevsky, Kochetov, and Simonov. Readings in Russian. 3 units. *Dobrenko or Lahusen*

283. Post-Stalinist and Contemporary Soviet Literature. Literature of the thaw after Stalin: the young prose, little realism, new modernism, and rural prose. Authors include

Aksyonov, Trifonov, Baranskaya, Bitov, Solzhenitsyn, Rasputin, Shukshin, and Zalygin. Readings in Russian. 3 units. *Dobrenko or Lahusen*

284. Literature under and after Glasnost. From the "recovered" avant-garde to the new literature during the Gorbachev era and beyond. The unmasking of Soviet history and its aestheticization. Underground literature and Soviet postmodernism. Authors include Rybakov, Pietsukh, Petrushevskaya, Kuraev, Tolstaya, Viktor Erofeyev, Makanin, Prigov, and Narbikova. Readings in Russian. 3 units. *Dobrenko, Gheith, or Lahusen*

285. Babel and the Russian-Jewish Cultural Dialogue of the Twentieth Century. The Jews and the Russian revolution. The Odessa school in the literature of the 1920s. Works include *Red Cavalry*, *Odessa Stories*, and *The Sunset*. Readings in English or Russian. 3 units. *Dobrenko*

286S. Zamyatin. The novel *We*, short fiction, and essays. Taught in English. Readings in English or Russian. Not open to students who have taken the former Russian 177S/277S (Zamyatin). 3 units. *Andrews, Maksimova, or Lahusen*

287S. Platonov. The novels *Cheovengur*, *The Foundation Pit*, and shorter fiction. Taught in English. Readings in English or Russian. 3 units. *Lahusen*

288S. Bulgakov. Works include *Master and Margarita*, *The White Guard*, *A Theatrical Novel*, and *The Heart of a Dog*. Readings in English or Russian. 3 units. *Andrews, Maksimova, and staff*

290. Trifonov, or the Life and Death of the Soviet Intelligentsia. The Russian and Soviet intelligentsia, its role and historical responsibility, depicted by one of the most visible representatives of the "generation of the sixties." Works include *The Exchange*, *Taking Stock*, *The Long Goodbye*, *Another Life*, *The House on the Embankment*, *The Old Man*. Readings in Russian. 3 units. *Dobrenko*

297. Russian Poetry. Focus on nineteenth and twentieth centuries, including the Golden Age and the Silver Age. Authors include Pushkin, Lermontov, Bely, Blok, Akhmatova, Tsvetaeva, Mandelshtam, Pasternak, and Mayakovsky. Taught in English or Russian, according to students' Russian language proficiency. Russian texts. 3 units. *Van Tuyt*

298. Akhmatova. The works and times of Anna Akhmatova, the most prominent woman poet in Russian history. Focus on Akhmatova's works and the Russian political and artistic milieu of the 1910s and 1920s, socio-literary issues of later periods. Readings include the lyric poems of 1910-60, *Requiem*, and *Poem Without a Hero*. Readings in Russian. 3 units. *Van Tuyt*

For Graduates

301, 302. Elementary Russian. Introduction to understanding, speaking, reading, and writing. Audiolingual techniques are combined with required recording-listening practice in the language laboratory. 3 units each. *Staff*

303, 304. Intermediate Russian. Intensive classroom and laboratory practice in spoken and written patterns. Reading in contemporary literature. Prerequisite: Russian 301, 302 or consent of instructor. 3 units each. *Staff*

305, 306. Advanced Russian Conversation and Readings. Nineteenth- and twentieth-century literature in the original. Conducted in Russian. Prerequisite: Russian 303, 304 or consent of instructor. 3 units each. *Staff*

307. Advanced Russian. Advanced grammar review with an emphasis on the refinement of oral and written language skills. Development of writing style through

compositions and essays. Prerequisite: Russian 306 or consent of instructor. 3 units. *Andrews*

308. Advanced Russian: Readings, Translation, and Syntax. Intensive reading and conversation with emphasis on contemporary Russian literary and Soviet press texts. English-Russian translation stressed. Russian media, including television and films. Prerequisite: Russian 307 or consent of instructor. 3 units. *Andrews*

309, 310. Russian Stylistics and Conversation. Refinement of stylistic control and range in spoken and written Russian. Emphasis on fluent discursive skills, as well as development of expository prose style. Prerequisites: Russian 307 and 308, or consent of instructor. 3 units each. *Maksimova*

311S, 312S. Advanced Russian Language and Culture. Advanced grammar review with additional emphasis on phonetics and conversation. Culture component includes literature, films, museums, and theater performances. (Taught in St. Petersburg in Russian.) Prerequisite: Russian 306 or equivalent. 3 units each. *Staff*

335. Contemporary Russian Media. Analytical readings and study of change and development in all the primary forms of former Soviet mass media from 1985 to the present (newspapers, journals, and television). Topics include censorship, TASS, samizdat. Taught in English. Readings in Russian. Prerequisite: Russian 64 or equivalent. 3 units. *Andrews*

350. Methods in Teaching Russian. The theory and practice of teaching Russian language to English-speaking students. 1 unit. *Andrews*

399. Special Readings. Advanced readings in nineteenth- and twentieth-century Russian literature in the original. 3 units. *Staff*

BALTO-FINNIC

For Seniors and Graduates

200. Balto-Finnic Linguistics. Introduction to Balto-Finnic languages with emphasis on the established literary languages, Finnish and Estonian. Analysis of their phonological and morphological structures. Survey of related nonliterary languages such as Karelian and Vepsian. Taught in English. 3 units. *Pugh*

POLISH

For Seniors and Graduates

274S. Topics in Polish Literature. Selected Polish writers and works in their literary and historical contexts. Includes responses of major European and American writers. Taught in English. 3 units. *Staff*

287. Introduction to Polish Literature. Survey of nineteenth- and twentieth-century Polish literature. Taught in English. 3 units. *Staff*

Sociology

Professor Land, *Chair* (268 Sociology-Psychology); Professor DiPrete, *Director of Graduate Studies* (265 Sociology-Psychology); Professors Cooke (public policy and economics), George, Kerckhoff, Lewin (business), Lin, Maddox, Myers, O'Barr (cultural anthropology), Simpson, Smith, Tiryakian, and Wilson; Associate Professors Gereffi, O'Rand, Spenner, and Weinberger (medicine and Aging Center); Assistant Professors Budros, Gold (psychiatry and Aging Center), Haveman (business), Janoski, Parnell, and Reed; Professors Emeriti Back and Preiss; Research Professor Manton (demographic studies); Visiting Professor Gittler

The department offers graduate work leading to the A.M. and Ph.D. degrees in sociology. Entering graduate students should already have completed a minimum of 12 semester hours in sociology and an additional 12 semester hours in related work (e.g., other social sciences, statistics, computer science, philosophy, mathematics). Accepted applicants who have not had such preparation may be required to take work beyond the usual requirements. Applicants for admission are required to take the verbal and quantitative aptitude tests of the Graduate Record Examination.

The Ph.D. program requires the student to take five core courses and a primary and additional courses in a secondary specialization. The core courses include: Sociological Theory (206), Social Statistics I and II (207, 212), and two out of three methods courses (208, 214, 215). Specializations (with the associated proseminars indicated in parentheses) include Life Course and Aging Studies (Sociology 221S); Comparative and Historical Sociology (Sociology 222S); Crime, Law, and Deviance (Sociology 223S); Population Studies (Sociology 224S); Organizations, Markets, and Work (Sociology 225S); Medical Sociology (Sociology 227S); and Stratification, Mobility, and Labor Force Behavior (Sociology 221S,A; 221S,B; 222S,B; 225S,D; 226S,B). A student entering with only an undergraduate degree and adequate course preparation would need to take fourteen courses to satisfy degree requirements. Up to fifteen credits, the equivalent of five courses, may be transferred for graduate work taken elsewhere.

Further details concerning the general departmental program, the specialities and their requirements, departmental facilities, the faculty, ongoing research, and stipends available may be obtained from the director of graduate studies.

For Seniors and Graduates

206. Sociological Theory. Structure, foundations, and historical antecedents of recent formulations of such theoretical approaches as phenomenological sociology, exchange theory, critical theory, structuralism, neo-Marxist sociology, sociobiology, and action theory. 3 units. *Tiryakian or Wilson*

207. Social Statistics I: Basic Concepts and Methods. Review of descriptive statistics; probability concepts; statistical inference, t-tests, and the analysis of variance. Bivariate correlation and regression, dummy variables, multiple regression, and the analysis of covariance. Stress on applications. Statistical computing using SPSS and other programs. 3 units. *DiPrete or Land*

208. Survey Research Methods. Theory and application of survey research techniques in the social sciences. Sampling, measurement, questionnaire construction and distribution, pretesting and posttesting, response effects, validity and reliability, scaling of data, data reduction and analysis. Prerequisite: Sociology 207 or the equivalent. 3 units. *Kerckhoff, Lin, or Smith*

211S, A-E. Proseminars in Sociological Theory. Development of sociological thought; systematic sociological theory; interrelations with other social and behavioral sciences.

- A. Background of Sociology
 - B. Formal Aspects of Theory
 - C. Sociology of Knowledge
 - D. Evolutionary Theory and Sociobiology
 - E. Special Topics in Sociological Theory
- 3 units. *Tiryakian or Wilson*

212. Social Statistics II: Linear Models, Path Analysis, and Structural Equation Systems. Model specification, review of simple regression, the Gauss-Markov theorem, multiple regression in matrix form, ordinary and generalized least squares, residual and influence analysis. Path analysis, recursive and nonrecursive structural equation mod-

els; measurement errors and unobserved variables. Application of statistical computing packages. Prerequisite: Sociology 207 or equivalent. 3 units. *DiPrete or Land*

213. Social Statistics III: Discrete Multivariate Models. Assumptions, estimation, testing, and parameter interpretation for the log-linear, logit, logistic, and probit models. Model comparisons; applications of statistical computing packages and programs. Prerequisite: Sociology 212 or equivalent. 3 units. *DiPrete or Land*

214. Comparative and Historical Methods. Introduction to the theory of comparative research and analysis in the social sciences with special emphasis on comparative methods, quasi-experimental designs, and case studies. C-L: Political Science 217. 3 units. *Archer, Gereffi, Janoski, Lin, Smith, or Tiryakian*

215. Basic Demographic Methods and Materials. Population composition, change, and distribution. Methods of standardizing and decomposing rates, life tables and population models, analysis of data from advanced and developing countries. Applications of computer programs for demographic analysis. Prerequisite: Sociology 207 or equivalent. 3 units. *Myers or Parnell*

216. Advanced Methods of Demographic Analysis. Theory and estimation methods for life tables. Reproductivity, the stable population model. Graduation, interpolation, and other data adjustments for faulty data. Hazards modeling. Applications of computer packages for demographic analysis. Prerequisite: Sociology 215 or equivalent. 3 units. *Land or Parnell*

217S, A-F. Proseminars in Social Statistics and Research Methods. Selected topics in the collection and analysis of social science data.

- A. Discrete and Continuous Models of Measurement
 - B. Hazards Models, Event History Analysis, and Panel Data
 - C. Dynamic Models and Time Series Analysis
 - D. Research Design
 - E. Evaluation Research Methods
 - F. Special Topics in Social Statistics and Research Methods
- 3 units. *DiPrete or Land*

221S, A-D. Proseminars in Aging and Life Course Analysis. Selected topics in socialization, human development, status attainment and careers, and the sociology of aging.

- A. Social Structure and the Life Course
 - B. Social Patterns of Personal Development
 - C. Social Gerontology
 - D. Special Topics in Aging and Life Course Analysis
- 3 units. *Maddox, Myers, O'Rand, or Spenner*

222S, A-D. Proseminars in Comparative and Historical Sociology. Selected topics in the differentiation and transformation of societies.

- A. Theories of Social Change
 - B. Comparative Aspects of Societal Transformation
 - C. Theories of Change in Third World
 - D. Special Topics in Comparative and Historical Sociology
- 3 units. *Gereffi, Lin, Simpson, Smith, or Tiryakian*

223S, A-E. Proseminars in Crime, Law, and Deviance. Selected topics in crime and the institutions of social control.

- A. Theories of Crime Causation
- B. Human Development and Criminal Careers
- C. Social Control and the Criminal Justice System
- D. Sociology of Law

E. Special Topics in Crime, Law, and Deviance
3 units. *Land, Reed, Simpson, or Wilson*

224S, A-F. Proseminars in Population Studies. Selected topics.

- A. Population Dynamics
- B. Mortality, Morbidity, and Epidemiology
- C. Urbanization and Migration
- D. Demography of the Labor Force
- E. Demography of Aging
- F. Special Topics in Population Studies

3 units. *DiPrete, Land, Maddox, Manton, Myers, O'Rand, Parnell, or Smith*

225S, A-E. Proseminars in Organizations, Markets, and Work. Selected topics in complex organizations, the labor process, and changing occupations.

- A. Organizations and Environments
- B. The Social Psychology of Organizations
- C. Markets and Market Behavior
- D. Careers and Labor Markets
- E. Special Topics in Organizations, Markets, and Work

3 units. *DiPrete, Janoski, O'Rand, or Spinner*

226S, A-G. Proseminars in Social Institutions and Processes. Selected topics in the sociology of institutions and social and institutional behavior.

- A. Social Psychology
- B. Social Stratification
- C. Political Sociology
- D. Sociology of Religion
- E. Sociology of Science
- F. Sociology of Education
- G. Special Topics in Social Institutions and Processes

3 units. *George, Gold, Lin, Maddox, or Weinberger*

227S, A-D. Proseminars in Medical Sociology. Selected topics in medical sociology.

- A. Social Structure and Health
- B. Social Behavior and Health
- C. Organization and Financing of Health Care
- D. Special Topics in Medical Sociology (for example, social epidemiology, stress and coping, health and aging)

3 units. *George, Gold, Lin, Maddox, or Weinberger*

234S. Political Economy of Development: Theories of Change in the Third World.

See C-L: Political Science 234S; also C-L: Cultural Anthropology 234S, History 234S. 3 units. *Staff*

255. Political Sociology. Pluralist, elite, and class theories of the relationship between state and society. Topics include: recent debates on the welfare state, social control, political participation, and state-society relations in socialist economies. C-L: Political Science 255. 3 units. *Smith or Tiryakian*

282S. Canada. See C-L: History 282S; also C-L: Cultural Anthropology 282S, Economics 282S, and Political Science 282S. 3 units. *Cahow or Thompson*

298S, 299S. Seminar in Selected Topics. Substantive, theoretical, or methodological topics. 3 units each. *Staff*

For Graduates

392. Individual Research in Sociology. Students will conduct on an individual basis research designed to evaluate a sociological hypothesis of their choice. The process must

be completed by preparation of a report on this research in adequate professional style. Prerequisite: Sociology 207, 208 or consent of instructor. 3 units. *Staff*

Institute of Statistics and Decision Sciences

Professor West, *Director* (333 Old Chemistry); Associate Professor Wolpert, *Director of Graduate Studies*; Professors Berry, Sacks, and Winkler; Associate Professors Burdick, Johnson, and Reckhow; Assistant Professors Lavine, Müller, Parmigiani, and Stangl; Adjunct Professor Peterson; Adjunct Associate Professor Wilkinson

The Institute of Statistics and Decision Sciences offers graduate study leading to the Ph.D. degree in statistics. It also offers the M.S. degree to students pursuing a Ph.D. degree in the institute or in another department at Duke. The institute is a regular teaching and research department of the University that is internationally recognized as a center of research in theoretical and applied statistics. The faculty are active in the areas of Bayesian statistics and decision sciences, statistical computing, and interdisciplinary applications of statistics. These areas of faculty interest are reflected in the course of study for students in the Ph.D. program offered by the institute.

Distinguishing features of graduate study are the opportunity for thorough preparation in Bayesian as well as classical statistics, and research opportunities at the interface between statistics, decision sciences, and statistical computing. The institute also enjoys close working relationships and research collaborations with other departments at Duke, providing opportunities for graduate students to become involved in applied projects.

Requirements for the Ph.D. degree in statistics include study of statistics, probability, statistical computing, decision sciences and related areas; passing a comprehensive examination (covering those topics) given at the end of the first year, and a preliminary examination (covering areas of possible research interest) at the end of the second year; and completing a dissertation written under the supervision of a faculty advisor.

For Seniors and Graduates

203S. Senior Seminar in Statistics. Illustrative list of past topics: empirical applications of classical and Bayesian methods; robustness and model specification; time series analysis; applications of probability theory. Prerequisite: Mathematics 136, Statistics 114, or Statistics 213. 3 units. *Staff*

205. Probability and Measure Theory. Introduction to probability spaces, the theory of measure and integration, random variables, and limit theorems. Distribution functions, densities, and characteristic functions; convergence of random variables and of their distributions; uniform integrability and the Lebesgue convergence theorems. Weak and strong laws of large numbers, central limit theorem. Prerequisites: elementary real analysis and elementary probability theory. 3 units. *Wolpert*

207. Probability. Prerequisite: Mathematics 281 or equivalent. See C-L: Mathematics 290. 3 units. *Staff*

210A. Statistics and Data Analysis for Policymakers. Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. Emphasis on public policy applications. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210B, or 213. C-L: Public Policy Studies 222. 3 units. *Staff*

210B. Statistics and Data Analysis in Biological Science. Elements of statistical inference and estimation including exploratory data analysis, regression, and analysis of variance. Emphasis on biological science applications. Not open to students who have had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210A, or 213. C-L: Environment 251. 3 units. *Staff*

had Mathematics 136 or Statistics 110A, 110B, 112, 113, 114, 210A, or 213. C-L: Environment 251. 3 units. *Staff*

213. Introduction to Statistical Methods. Emphasis on classical techniques of hypothesis testing and point and interval estimation, using the binomial, normal, t , F , and chi square distributions. Not open to students who have had Statistics 114 or Mathematics 136. Prerequisite: Mathematics 103 (may be taken concurrently) or equivalent, or consent of instructor. 3 units. *Pole*

214. Probability and Statistical Models. An introduction to applied probability and to the parametric probability models commonly used in statistical analysis. The generation of random variables with specified distributions, and their use in simulation. Mixture models; linear regression models; random walks, Markov chains, and stationary and ARMA process; networks and queueing models. Prerequisites: Mathematics 103 and 104 or consent of instructor. 3 units. *Staff*

215. Statistical Inference. Classical, likelihood, and Bayesian approaches to statistical inference. Foundations of point and interval estimation, and properties of estimators (bias, consistency, efficiency, sufficiency, robustness). Testing: Type I and II errors, power, likelihood ratios; Bayes factors, posterior probabilities of hypotheses. The predictivist perspective. Applications include estimation and testing in normal models, exponential families, regression and one-way ANOVA, contingency tables. Hierarchical normal models; model choice and criticism. Prerequisite: Statistics 213 or co-registration in Statistics 214 or consent of instructor. 3 units. *Staff*

216. Generalized Linear Models. Likelihood-based inference in generalized linear models (GLIMs). Multiple linear regression, theory, and practice. Elements of Bayesian analyses of linear models. Theory of likelihood-based inference for GLIMs. Factor variables and cross-classified data arrays. Discrete models: binary regressions and simple contingency tables. Introduction to log-linear models. Data analysis: model fitting, model choice, and residuals-based diagnostics. Prerequisites: Statistics 214 and coregistration in Statistics 215 or equivalent. 3 units. *Staff*

221. Bayesian Inference and Decision. Not open to undergraduates. See C-L: Business Administration 510. 3 units. *Winkler*

226. Statistical Decision Theory. Formulation of decision problems; criteria for optimality: maximum expected utility and minimax. Axiomatic foundations of expected utility; coherence and the axioms of probability (the Dutch Book theorem). Elicitation of probabilities and utilities. The value of information. Estimation and hypothesis testing as decision problems: risk, sufficiency, completeness and admissibility. Stein estimation. Bayes decision functions and their properties. Minimax analysis and improper priors. Decision theoretic Bayesian experimental design. Combining evidence and group decisions. Prerequisite: Statistics 215 or consent of instructor. 3 units. *Staff*

231. Behavioral Decision Theory. Not open to undergraduates. See C-L: Business Administration 525. 3 units. *Payne*

234. Choice Theory. Not open to undergraduates. See C-L: Business Administration 513. 3 units. *Staff*

242. Applied Regression Analysis. Linear regression using both graphical and numerical methods. Model construction, critique, and correction using graphical residual analysis. One-way and two-way analysis of variance; introduction to design of experiments. Use of a standard statistical software package. Applications and examples drawn from various sources, emphasizing the biological and environmental sciences. Prerequisite: Statistics 210B or equivalent. 3 units. *Staff*

244. Linear Models. Multiple linear regression. Estimation and prediction. Likelihood, Bayesian, and geometric methods. Analysis of variance and covariance. Residual analysis and diagnostics. Model building, selection, and validation. Prerequisites: Mathematics 104 and Statistics 113 or 210. C-L: Mathematics 241. 3 units. *Staff*

245. Introduction to Multivariate Statistics. Multinormal distributions, multivariate general linear model, Hotelling's T^2 statistic, Roy union-intersection principle, principal components, canonical analysis, factor analysis. Prerequisite: Statistics 244 or equivalent. C-L: Mathematics 242. 3 units. *Burdick*

246. Experimental Design. Randomization, blocks, factors, and treatments; random and fixed effects; fractional factorial, Latin squares, and other designs; estimation and testing; optimal design and allocation; informational design. Prerequisites: Statistics 213 and 244 or equivalent. 3 units. *Staff*

253. Applied Stochastic Processes. Prerequisite: Mathematics 135 or equivalent. See C-L: Mathematics 240. 3 units. *Staff*

265. Econometrics II. Prerequisite: Economics 243 or equivalent. See C-L: Economics 245. 3 units. *Tauchen*

266. Econometrics III. Prerequisite: Economics 245. See C-L: Economics 246. 3 units. *Gallant and Tauchen*

273. Numerical Analysis. Prerequisites: knowledge of an algorithmic programming language, intermediate calculus including some differential equations, and Mathematics 104. See C-L: Computer Science 221; also C-L: Mathematics 221. 3 units. *Gardner, Greenside, Lanzkron, or Rose*

282. Optimization Methods. Optimization techniques useful in decision making. Numerical techniques for nonlinear optimization, with and without constraints; linear and quadratic programming; applications. Other topics, including dynamic programming, optimal control, and stochastic methods, as time permits. Prerequisites: Mathematics 32 and 104 or equivalent, or consent of instructor; knowledge of a computer programming language is helpful but not required. 3 units. *Wolpert*

290. Case Studies in Applied Statistics. Data management and collection, sampling and design, exploratory data analysis, graphical and tabular displays, summarizing data. Case studies from various disciplines such as biostatistics, economics, medical decision making, engineering, and business administration presented by various faculty members. Introduction to applied work through workshops, consultancy, and research literature. Computer orientation, statistical packages and operating systems, graphics, and numerical computing. May be taken more than once. 3 units. *Staff*

291, 292. Independent Study. Directed reading and research. Consent of instructor and director of graduate studies required. 3 units each. *Staff*

293. Special Topics in Statistics. Advanced topics in analysis of variance, design of experiments, nonparametric statistics, foundations of statistical inference. Prerequisite: Statistics 213 or consent of instructor. 3 units. *Staff*

297. Topics in Probability Theory. Prerequisite: Mathematics 290 or consent of instructor. See C-L: Mathematics 293. 3 units. *Staff*

For Graduates

333. Sequential Statistical Analysis. Bayesian analysis of sequential statistical procedures. Multi-armed bandit problems: sampling costs and decision costs, Bayesian updating, myopic rules, dynamic programming. Contemporary design of clinical trials. At the level of Sheldon Ross, *Introduction to Stochastic Dynamic Programming* and part

four of Morris H. DeGroot, *Optimal Statistical Decisions*. Prerequisite: Statistics 215 or equivalent. 3 units. *Berry*

345. Multivariate Statistical Analysis. Review of matrix algebra, transformations, and Jacobians. The multivariate normal, Wishart, multivariate t , and related distributions are given special emphasis. Topics such as principal components, factor analysis, discrimination and classification, and clustering treated both from classical and Bayesian viewpoints. Additional topics depending on instructor and background of students. Prerequisites: Statistics 215 and Statistics 216. 3 units. *Staff*

346. Experimental Design and Optimization. Traditional and modern concepts and techniques in statistical design and experimentation. Industrial experimentation and statistical design in complex, high-dimensional control spaces. Fractional factorial designs and highly fractionated experiments. Response surface methodology. Determination of nonlinearities in response surfaces. Efficient allocation of experimental units to control and treatments, especially with small numbers of expensive units. Bayesian and classical design criteria of optimality. Sequential design and allocation. Prediction from designed experiments. Screening and sensitivity. Data assimilation and tuning. Possible illustrations from studies in semiconductor manufacturing and drug design. 3 units. *Sacks*

356. Time Series and Forecasting. Time series data and models: trend, seasonality, and regressions. Traditional models: EWMA, EWR, ARMA. Dynamic linear models (DLMs). Bayesian learning, forecasting, and smoothing. Mathematical structure of DLMs and related models. Intervention, forecast monitoring, and control. Structural change in time series. Multiprocess models and mixture analysis. Multivariate models, constrained and aggregate forecasting, and forecast combination. Applications using computer software. Other topics, including spectral analysis, as time permits. Prerequisite: Statistics 215 or equivalent. 3 units. *West*

357. Stochastic Processes. Conditional probabilities and Radon-Nikodym derivatives of measures; tightness and weak convergence of probability measures, measurability and observability. Markov chains, Brownian motion, Poisson processes. Gaussian processes, birth-and-death processes, and an introduction to continuous-time martingales. Prerequisites: Statistics 205 (or Mathematics 290) and Statistics 215 (or Mathematics 136.) 3 units. *Lawler or Wolpert*

365. Survival Reliability Analysis. Statistical models and techniques useful in the comparative study of lifetime distributions. Censoring mechanisms. Empirical and nonparametric methods of survival-curve estimation, graphical methods. Classical, likelihood, and Bayesian inference in parametric models. Survival regression models: proportional and nonproportional hazards models. Accelerated failure time models. Stochastic mechanisms inducing lifetime distributions. Multivariate failures. Competing risks. Multivariate exponential, and other distributions. Mixtures of failure time distributions. Applications in medicine, engineering, economics. Prerequisites: Statistics 215 and 216. 3 units. *Parmigiani, West, or Wolpert*

376. Advanced Modeling and Scientific Computing. An introduction to advanced statistical modeling and modern numerical methods useful in implementing statistical procedures for data analysis, model exploration, inference, and prediction. Topics include simulation techniques for maximization and integration. Prerequisite: Computer Science 221 or equivalent. 3 units. *Müller*

380. Quantitative Methods and Statistics. Review of multivariate calculus, optimization methods, and linear algebra for statistics; introduction to probability and statistics, with emphasis on applications of the theory to applied problems. Not open to

students who have taken Statistics 112 or 213. Prerequisite: Mathematics 32, 34, 36 or 41, or consent of instructor. 6 units. *Staff*

381. Nonlinear Regression. Likelihood and Bayesian approaches to model identification (or parameter estimation) and prediction in nonlinear models. Numerical solution of nonlinear optimization problems with and without constraints: derivative-free methods, quasi-Newton methods, successive quadratic programming, stochastic methods (simulated annealing, genetic algorithms). Conditioning, convergence, identifiability problems. Model selection and validation. Applications include growth models, PDE models, pharmacokinetic models. Prerequisites: Statistics 216 and 376 or equivalent. 3 units. *Staff*

386. Noncooperative Game Theory. See C-L: Economics 315; also C-L: Political Science 315. 3 units. *Meurer or Moulin*

390. Statistical Consulting Workshop. Under faculty supervision, students address and solve consulting problems submitted to ISDS's campus-wide consulting program, and present their solutions to the class. May be taken more than once. Consent of instructor required. 1 unit. *Burdick or Johnson*

COURSES CURRENTLY UNSCHEDULED

294. Special Topics in Statistics

298. Topics in Probability Theory

The Master of Arts in Teaching Program

Diane Sasson, Ph.D., *Director*

The Master of Arts in Teaching program (MAT) is designed for talented liberal arts graduates who wish to teach their discipline in secondary schools. The MAT degree requires 36 units of graduate credit, consisting of 18 units (six courses) within the student's discipline, six units (three courses) of MAT-specific education courses, and twelve units devoted to a year-long internship/seminar.

More information on the program is available from Dr. Sasson, MAT Director, 138 Social Sciences Building, Box 90093, Duke University, Durham, North Carolina 27706.

301. Perspectives on Education. Educational issues studied within American historical, social, and cultural perspectives. Students examine current trends in education including school choice and reform, teacher empowerment and accountability, standardized curricula and testing, school funding and governance, multi-culturalism and changing demographics, and outcome based education and mastery learning. Open only to MAT students. 2 units. *Staff*

302. Educating Adolescents. Focus on understanding the adolescent as a learner. Study of selected theories of adolescent development and theories and principles of educational psychology emphasizing secondary education. Open only to MAT students. 2 units. *Staff*

303. Effective Teaching Strategies. During the first part of the course students learn general teaching strategies for secondary classrooms such as time management, student behavior management, planning for instruction, instructional presentation, designing effective lessons, feedback, promoting critical thinking skills, and cooperative learning. In the second part students work on methodologies in specific subject area groups. Open only to MAT students. 2 units. *Staff*

341. Internship and Reflective Practice. During fall semester MAT students are placed in supervised internships in local high schools under the direction of trained and

certified mentor teachers. The accompanying seminar provides students with an understanding of the adolescent as learner, and opportunities for directed reflection on themselves as teachers and learners, and their students as learners. Open only to MAT students. 6 units. *Staff*

342. Internship and Content Methodology. The internship continues through second semester under the supervision and coaching of the mentor. The seminar brings together interns, high school teachers, and content faculty members in specific subject area groups to explore emerging knowledge in the discipline, and the ways that knowledge is best delivered in the high school classroom. Open only to MAT students. 6 units. *Staff*

The University Program in Toxicology

Professor Graham, *Director and Acting Director of Graduate Studies* (M255 Davison Building); Professor Abou-Donia, *Deputy Director* (020 Research Park IV); James B. Duke Professor Fridovich, *Deputy Director* (231 Nanaline Duke Building); Professor Richardson, *Deputy Director* (05 Biological Sciences Building); Adjunct Associate Professor Gad

The University Program in Toxicology seeks to produce investigators with sound training in the scientific basis for research in toxicology who will advance the science of this discipline. After broad general courses in epidemiology and statistics, pathology, and mammalian toxicology, students will be trained in one of three tracks: (1) as generalist toxicologists, with broad training in the principles and concepts of toxicology and the design of protocols for toxicological assessments; (2) as specialist toxicologists in those areas of toxicology research in which faculty members are currently productive including pulmonary toxicology, neurotoxicology, immunotoxicology, genetic toxicology (carcinogenesis), and biochemical toxicology; or (3) as ecotoxicologists with broad training in principles and concepts of both toxicology and ecology as they relate to the release, transport, exposure, accumulation, and effects of toxicants in the ecosystem.

The toxicology program faculty is comprised of members from the Departments of Anesthesiology, Biochemistry, Cell Biology, Chemistry, Medicine, Neurobiology, Pathology, Pharmacology, and Zoology and the School of the Environment, including the Duke University Marine Laboratory.

Students seeking a Ph.D. in one of the participating Graduate School departments must make initial application to that department. Students who apply initially for graduate study in one of the departments may also be nominated by that department for admission to the program. Such students should list toxicology as their "Special Field" on the application form. It is expected that most students will have a strong undergraduate preparation in mathematics and the physical and biological sciences with demonstrated excellence of performance as judged by grades in course work and letters of recommendation from former instructors. Each student in the program will take a series of courses in toxicology as well as courses specified by his or her department. A student will be expected to choose a dissertation advisor in his or her department at least by the end of the first two semesters in the program, and will normally be expected to begin dissertation research during the third semester in residence. Upon satisfactorily completing all degree requirements in the program and in the department, students will be jointly recommended for the Ph.D. degree.

Further information may be obtained from the director of the Toxicology Program.

Women's Studies

Professor of the Practice and Adjunct Professor Jean F. O'Barr, *Director* (207 East Duke Building); Professor Carol Meyers, *Associate Director*

Graduate and professional students enrolled at Duke University are encouraged to participate in the Women's Studies Program. Participation includes doing graduate level

work in women's studies courses, earning a graduate certificate in women's studies, conducting research on gender-related topics, selecting feminist theory and/or women's studies as a prelim area, writing masters' and doctoral theses in feminist scholarship, and attending lectures, seminars, conferences, discussion groups, and other campus events sponsored by the program. Duke University is one of a growing number of graduate institutions to offer a certificate in women's studies at the graduate level.

Graduate students affiliate with the program by submitting, in writing, their intention to take courses and do research on women and gender systems during the course of their studies here. Affiliated students are put on the mailing list and receive calendars, newsletters, lecture notices, and invitations to special events. Soup and sandwich suppers for graduate students are held monthly and take up topics of concern for feminist scholars; notices are sent each month. A *Guide to Graduate Student Research on Women and Gender*, outlining the work of students affiliated with the program, is published annually. Students wishing to have their name and work listed should contact the program office. An annual research conference organized by the students affiliated with the program is held each year. Information on participation is available in the office. Also available in the office are copies of the Women's Studies Core Bibliography, a collection of recommended texts from feminist scholars across the university, useful for building prelim lists and as an interdisciplinary reference for students' research.

Graduate work in women's studies takes place both in interdisciplinary seminars and in courses offered through departments. In addition to these possibilities, graduate students are encouraged to develop independent study courses, either with a member of the faculty affiliated with women's studies or in conjunction with the courses offered through the undergraduate Women's Studies Program.

The Women's Studies Program offers a certificate to qualified students in A.M., Ph.D., and professional degree programs of the university. To qualify for the graduate certificate, students must pass a minimum of three graduate level courses on women and gender. Women's Studies 211S, History of Feminist Thought, is the core course for the certificate and the only required one. The second and third courses are chosen by the student from departmental offerings to build on their disciplinary training and demonstrate a breadth of knowledge about women, culture, and society. Students' course plans are approved by the Women's Studies Advisory Committee as early as possible in their graduate careers. Students in the Divinity School and those earning an A.M. in Liberal Studies have individualized graduate certificate requirements and need to consult the director. The award of the graduate certificate in women's studies is carried on the student's official university transcript upon completion of the work. A recognition ceremony is held each September for students who have earned the certificate. Students earning the certificate have priority for women's studies funding.

211S. History of Feminist Thought. A multidisciplinary overview of the rise of feminist scholarship in the disciplines; the investigation of feminist writers prior to the twentieth century; the evolution of women's studies as a discipline, with consideration of pedagogical and methodological questions; an examination of the future contours of feminist scholarship. 3 units. *E. DeLamotte, J. O'Barr, and others*

391, 392. Tutorial in Special Topics. Directed research and writing in areas unrepresented by regular course offerings. Consent of instructor required. 3 units each. *J. Hamilton or J. O'Barr*

COURSES CURRENTLY UNSCHEDULED

283S. Feminist Theory and the Humanities

284S. Feminist Theory and the Social Sciences

COURSES ON WOMEN OFFERED BY DEPARTMENTS AND PROFESSIONAL SCHOOLS

Christian Education 255. History of Women in Methodism. *Felton*
 Christian Theology 214. Feminist Theology. *McClintock-Fulkerson*
 Cultural Anthropology 215S. The Anthropology of Women: Theoretical Issues. *Staff*
 Cultural Anthropology 252. American Marriage: A Cultural Approach. *Quinn*
 Economics 208S. Economics of the Family. *McElroy*
 English 269. American Women Writers. *C. Davidson, Pope, or Tompkins*
 English 288. Western in American Culture. *Tompkins*
 English 321. Gender and Power in Renaissance Texts. *DeNeef*
 English 381. Sex/Gender/Representation: Gay and Lesbian Literary Traditions. *Moon and Sedgewick*
 English 381. Ways of Knowing. *Torgovnick*
 French 290S. Studies in a Contemporary Figure: Wittig. *Orr*
 French 391. French Seminar: Autobiography. *Kaplan*
 French 391. French Seminar: The Epistolary Genre. *Farrell*
 German 254S. Literature by Women. *Rasmussen*
 German 275S. German Women Writers. *Rasmussen*
 History 221. Gender and the State in Early Modern Europe. *Neuschel*
 History 227-228. Recent United States History: Major Political and Social Movements. *Chafe*
 History 351. Colloquium in Women's History. *Staff*
 Law 335. Family Law. *Bartlett*
 Law 529. Feminist Legal Theory. *Morris*
 Literature 254. Introduction to Feminism. *Moi or Radway*
 Literature 284. Intellectual as Writer: Simone de Beauvoir. *Moi*
 Literature 289. Topics in Feminist Theory. *Moi, Radway, or Tompkins*
 Philosophy 203S. Contemporary Ethical Theories. *Lind*
 Political Science 200S.A. Contemporary American Feminism. *J. O'Barr*
 Public Policy Studies 264S. Gender and Social Policy. *Malson*
 Public Policy Studies 264S. Poverty and Public Policy. *Malson*
 Public Policy Studies 264S. Family Policy. *Malson*
 Public Policy Studies 278. Human Service Bureaucracies. *Malson*
 Religion 234. Early Christian Asceticism. *Clark*
 Religion 253. Feminist Theory and the Study of Christianity. *Clark and McClintock-Fulkerson*

Zoology

Professor H. Nijhout, *Chair* (227 Biological Sciences); Associate Professor Roth, *Director of Graduate Studies* (226 Biological Sciences); Professors Barber, Forward, Gillham, Klopfer, Laurie, Livingstone, McClay, Nicklas, Rausher, Simons, Staddon, Sutherland, Terborgh, Tucker, Uyenoyama, Vogel, Wainwright, and Ward; Associate Professors Brandon, Rittschof, and K. Smith; Assistant Professors Crenshaw, Fehon, Morris, and Nowicki; Professors Emeriti Bailey, Bookhout, Fluke, Gregg, Schmidt-Nielsen, and K. Wilbur; Adjunct Professor Schmidt-Koenig; Adjunct Associate Professor M. Nijhout

The Department of Zoology manages a variety of programs tailored to individual needs of students seeking the Ph.D. degree. A master's degree may be taken by students en route to the Ph.D., or by those who leave the doctoral program. Ordinarily, only students seeking the doctorate are admitted to the department. In general, students entering the department will be equipped to pursue advanced degrees if they have completed an undergraduate major in biology along with some formal training in college level chemistry, mathematics, physics, and foreign languages. A reading knowledge of one foreign language is required of all doctoral students in zoology.

Nevertheless, in recognition and support of the modern trend toward interdisciplinary research, the department is prepared to accept promising students with less orthodox academic backgrounds and is ready to encourage any student wishing to undertake a program of study leading, in effect, to an interdisciplinary degree sponsored by the department.

Thus, all students are urged to search widely in both the *Bulletin of Duke University: Undergraduate Instruction* and the *Bulletin of Duke University: Graduate School* for information about the intellectual resources of the university. Special attention should be given to announcements of the Departments of Biochemistry, Biological Anthropology

and Anatomy, Botany, Cell Biology, Chemistry, Cultural Anthropology, Geology, History, Immunology, Mathematics, Microbiology, Pharmacology, Philosophy, Psychology, Sociology, and Zoology; announcements of the School of Engineering and the School of the Environment should also be consulted.

For Seniors and Graduates

The *L* suffix on a zoology course number indicates that the course includes a laboratory.

201L, S. Animal Behavior. Survey of past developments and current controversies in animal behavior. Extensive readings, followed by individual experimental or descriptive projects in the laboratory or field (or Primate Center). Recommended background: Biology 21L and 22L; Biology 151L; and statistics; or equivalents. 4 units. *Klopfer*

203L. Marine Ecology. Factors that influence the distribution, abundance, and diversity of marine organisms. Course structure integrates lectures, field excursions, and independent research projects. Topics include characteristics of marine habitats, adaptation to environment, species interactions, biogeography, larval recruitment, rocky shores, marine mammals, fouling communities, tidal flats, beaches, subtidal communities, and coral reefs. (Given at Beaufort.) Prerequisite: none; suggested—introductory ecology, invertebrate zoology, or marine botany. C-L: Environment 219L and Marine Sciences. 6 units. *Gerhart*

206S. Controversies in Biology. A contentious theme for reading, discussion, and an individual or joint paper. Illustrative past topics: the nature of the creative process, causality in biological thought, the lack of political impact of many scientific developments. Open to nonmajors. 3 units. *Klopfer*

213L. Behavioral Ecology. How ecological factors shape foraging, mating, aggressive, and social behavior. Laboratory experiments and field observations from the Outer Banks environment. Independent projects and seminars. (Given at Beaufort.) Prerequisite: introductory biology. C-L: Marine Sciences. 4 units. *Rubenstein (visiting summer faculty)*

215. Tropical Ecology. Ecosystem, community, and population ecology of tropical plants and animals with application to conservation and sustainable development. Prerequisite: a course in general ecology. C-L: Botany 215 and Environment 217. 3 units. *Terborgh*

216L. Limnology. Lakes, ponds, and streams; their origin, development, geochemistry, energy balance, productivity, and the dynamics of plant and animal communities. Laboratory includes field trips. Offered biennially. Prerequisites: Biology 21L and 22L; and Chemistry 12L and Mathematics 32 and physics; or equivalents; or consent of instructor. 4 units. *Livingstone*

222L. Entomology. The biology of insects: diversity, development, physiology, and ecology. Field trips. Prerequisite: introductory biology. 4 units. *H. Nijhout*

223. Analysis of Ocean Ecosystems. The history, utility, and heuristic value of the ecosystem; ocean systems in the context of Odum's ecosystem concept; structure and function of the earth's major ecosystems. Term paper required. (Given at Beaufort.) Prerequisite: one year of biology, one year of chemistry, or consent of instructor. C-L: Environment 293 and Marine Sciences. 3 units. *Barber*

229L. Paleoecology. Global change over the last two million years. Prerequisites: two semesters of biology or geology; and one semester each of calculus, chemistry, and physics; or consent of instructors. C-L: Botany 229L. 3 units. *Bush, Clark, and Livingstone*

234S. Problems in the Philosophy of Biology. Consent of instructor required. See C-L: Philosophy 234S; also C-L: Botany 234S. 3 units. *Brandon (philosophy)*

237L. Systematic Biology. Theory and practice of identification, species discovery, phylogeny reconstruction, classification, and nomenclature. Prerequisites: Biology 21L and 22L or equivalents. C-L: Botany 237L. 3 units. *Mishler (botany)*

244. Principles of Immunology. Prerequisites: Biology 160 and Chemistry 151L or equivalents. See C-L: Immunology 244. 3 units. *Kostyu (immunology), McClay, and staff*

245S. Radiation Biology. The biological effects of ionizing radiations: classical concepts in the context of recent research papers. Analytical uses of radiation. Prerequisites: introductory biology, Chemistry 11L, 12L, and Physics 51L, 52L. 3 units. *Staff*

247S. Photobiology. Effects of visible light and of ultraviolet and near ultraviolet radiation in living systems: repair processes, quantum processes, physical optics. Prerequisites: college physics and introductory biology. 3 units. *Staff*

249. Comparative Biomechanics. The structure and operation of organisms in relation to the mechanics of solids and fluids, including readings from the primary literature. Not open to students who have taken Biology 149. Prerequisites: Mathematics 31 and Physics 51L or equivalents. 3 units. *Vogel and Wainwright*

250L. Physiology of Marine Animals. Environmental factors, biological rhythms, and behavioral adaptations in the comparative physiology of marine animals. Four units (fall); six units (summer). (Given at Beaufort.) Prerequisites: introductory biology and chemistry. C-L: Marine Sciences. Variable credit. *Forward*

255L. Biochemistry of Marine Animals. Functional, structural, and evolutionary relationships of biochemical processes of and importance to marine organisms. (Given at Beaufort.) Prerequisites: introductory biology and inorganic chemistry. C-L: Marine Sciences. 4 units. *Rittschof*

259L. Laboratory in Biomechanics. Introduction to instruments used in investigations of solid and fluid biomechanics. Exercises and individual projects. Prerequisite: Zoology 249. 3 units. *Vogel and Wainwright*

262. Biology of Parasitism. How parasites, from viruses through vertebrates, have solved the special problems associated with their dependence on other organisms. Emphasis on life cycles, host-parasite interactions, and experimental parasitology. Prerequisites: Biology 22L and 160 or equivalents. 3 units. *M. Nijhout*

267L. Community Ecology. Mechanisms that determine the distribution and abundance of plants and animals: geology, climate, physiography, soils, competition, predation, and history. Lectures focus on ecological principles. Seminars and weekend field trips. Prerequisites: an introductory ecology course and consent of instructor. C-L: Botany 267L. 3 units. *Christensen (botany)*

269. Advanced Cell Biology. Structural and functional organization of cells and their components with emphasis on current research problems and prospects. Prerequisite: introductory cell biology or consent of instructor. C-L: Botany 269, Cell and Molecular Biology 269, Cell Biology 269, Immunology 269, and Microbiology 269. 3 units. *Nicklas and staff*

274L. Biology of Marine Invertebrates. Structures, functions, and habits of invertebrate animals under natural and experimental conditions. Field trips. Not open to students who have taken Biology 176L. (Given at Beaufort.) Prerequisites: Biology 21L and 22L or equivalents. C-L: Environment 297L and Marine Sciences. 6 units. *Staff*

280. Principles of Genetics. Structure and properties of genes and chromosomes in individual organisms and in populations. Prerequisite: introductory biology. C-L: Bot-

any 280 and The University Program in Genetics. 3 units. *Antonovics (botany), Boynton (botany), Gillham, and Laurie*

281. DNA, Chromosomes, and Evolution. The relationship of chromosome and DNA-sequence organization with evolution; karyotype changes and speciation; repetitive DNA, split genes, transposable elements, and evolutionary mechanisms; phylogeny reconstruction; evolution of mitosis and the chromosome cycle. Prerequisite: an introductory course in genetics or cell or molecular biology, or consent of instructor. C-L: The University Program in Genetics. 3 units. *Laurie and Nicklas*

283. Molecular Genetics of Organelles. Genetics, biochemistry, and molecular biology of the organelles of eukaryotic cells, and cellular symbionts. Emphasis on recent literature. Prerequisite: introductory genetics. C-L: Botany 283 and The University Program in Genetics. 3 units. *Boynton (botany) and Gillham*

286. Evolutionary Mechanisms. Prerequisites: Biology 21L and 22L; and Biology 180 or equivalents. See C-L: Botany 286; also C-L: The University Program in Genetics. 3 units. *Antonovics (botany) and Uyenoyma*

287S. Macroevolution. Evolutionary patterns and processes at and above the species level; species concepts, speciation, diversification, extinction, ontogeny and phylogeny, rates of evolution, and alternative explanations for adaptation and evolutionary trends. Prerequisites: Biology 21L and 22L or equivalents. C-L: Biological Anthropology and Anatomy 287S and Botany 287S. 3 units. *Mishler (botany) and Roth*

288. Mathematical Population Genetics. Principles of formulation and analysis of dynamic mathematical models of genetic evolution. Rotating topics include: mating systems, sex ratio, stochastic processes. Prerequisites: calculus; statistics and linear algebra recommended. C-L: The University Program in Genetics. 3 units. *Uyenoyama*

289. Methods in Morphometrics. Techniques for the acquisition and analysis of quantitative data for describing and comparing biological form. Topics include: image capture and analysis, two- and three-dimensional digitization, and multivariate and geometric techniques such as allometric analysis, outline and landmark-superposition methods, and deformation models. Background in statistics and linear algebra recommended. 3 units. *Mercer*

290. Pattern and Process in Vertebrate Development. Prerequisites: course in comparative or human anatomy and consent of instructor. See C-L: Biological Anthropology and Anatomy 290. 3 units. *Smith*

295S, 296S. Seminar. Topics, instructors, and course credits announced each semester. Variable credit. *Staff*

For Graduates

353, 354. Research. To be carried on under the direction of the appropriate staff members. Hours and credit to be arranged. C-L: Marine Sciences. Variable credit. *Staff*

360, 361. Tutorials. An approved academic exercise, such as writing an essay or learning a research skill, carried out under the direction of the appropriate staff members. Hours and credit to be arranged. Variable credit. *Staff*

364. Ungraded Research. To be carried on under the direction of the appropriate faculty members. Hours to be arranged. Variable credit. *Staff*

COURSES CURRENTLY UNSCHEDULED

226L. Ichthyology

355, 356. Seminar

Special Study Centers, Programs, and Opportunities



Center for the Study of Aging and Human Development

The center is a multidisciplinary program devoted to research, training, and clinical activities in gerontology and geriatrics. Although the center does not offer degrees, the varied programs, research laboratories, and clinical settings provide a context and resource for undergraduate and graduate students and for health professionals with special interests in adult development and aging. The center conducts multidisciplinary, two-year programs for postdoctoral fellows interested in focused training for independent research on many varied aspects of aging and adult development. Resources of this all-university program include data from two longitudinal studies, a wide range of archival data of special interest to social scientists, a human subjects registry, and the center's basic and applied research laboratories. A division of geriatrics coordinates research, training, and services related to the care of older adults. Undergraduate and graduate students of the University are welcome to inquire about participation in all programs at the center. Inquiries should be addressed to Harvey Jay Cohen, M.D., Director, Duke University Center for the Study of Aging and Human Development, Box 3003, Duke University Medical Center, Durham, North Carolina 27710.

Asian/Pacific Studies Institute

The institute sponsors an agenda of visiting speakers and scholars and coordinates study abroad programs in China and Japan. A limited number of fellowships are granted which provide stipends for a two-year period. Incoming graduate students with the Ph.D. as their objective, students in good standing in the first year of study in Duke professional schools, and current Duke students enrolled in Ph.D. programs may be considered for these fellowships. Additional one-year fellowships are available for incoming students with a concentration on China. Further information may be obtained from the Asian/Pacific Studies Institute, 2111 Campus Drive, Box 90411, Duke University, Durham, North Carolina 27708-0411.

Center for Biochemical Engineering

The Center for Biochemical Engineering offers a broad and versatile education in the application of engineering principles to problems involving living cells and their biochemical products. Students follow a course of study that integrates advanced principles of biochemical and process engineering with cell biology, microbiology, biochemistry, and genetics. The center emphasizes the Ph.D., although M.S. and interdisciplinary undergraduate programs are available. The detailed program is tailored to each student's interests and background. Students with either engineering or scientific undergraduate degrees are encouraged to apply to the graduate program. Additional information may be obtained from the Director of Graduate Studies, Center for Biochemical Engineering, School of Engineering, Duke University, Durham, NC 27706.

Canadian Studies Program

The Canadian Studies Program is supported in part by grants from the U.S. Department of Education, and by occasional funds from the departments of Canada's provincial and federal governments. Its purpose is to formalize and expand the interest of graduate students in Canada, to introduce the study of Canadian life and culture at the undergraduate level, and to encourage such study in primary and secondary schools.

The program awards a limited number of graduate fellowships and teaching assistantships for the study of Canada to American residents. Fellows must work on a Canadian dissertation topic within their disciplines and must also study French. Grants of travel aid for field research in Canada are also offered.

The program sponsors lectures by Canadian specialists and supports seminars devoted to Canada. Opportunities for study in Canada are offered to honors undergraduates in Canadian Studies, graduates, and faculty.

Inquiries should be addressed to the Director, Canadian Studies Center, Duke University, Box 90422, Durham, North Carolina 27708-0422.

Center for Documentary Studies

This interdisciplinary center for research, teach, and the dissemination of documentary work is dedicated to encouraging and supporting the work of photographers, filmmakers, historians, journalists, novelists, and others who work by direct observation and participation in the lives of individuals and communities. The center is currently focusing on four areas of research: the American family, African American life and race relations, law and politics, and ecology and the environment. The center offers courses under the auspices of several Duke departments including History, Public Policy Studies, Education, and English, and a variety of center-sponsored projects offer a limited number of assistantships to graduate students in the arts and humanities. For more information contact Iris Tillman Hill, Director, Center for Documentary Studies, 331 West Main Street, 5th Floor, Snow Building, Durham, North Carolina 27701.

Center on East-West Trade Investments and Communications

This purpose of this research institute is to study change in contemporary socialist societies. Its visiting scholar program provides fellowships to advanced doctoral candidates and postdoctoral scholars who are looking at questions of Soviet domestic political and economic reform. These fellows and visiting Soviet and Western scholars are available to university students for consultation. For more information, contact Professor Jerry F. Hough, Director, Center on East-West Trade Investments and Communications, 2114 Campus Drive, Durham, North Carolina 27706.



Center for Health Policy Research and Education

The Center for Health Policy Research and Education provides a focal point at Duke for educational activities in health policy. The center faculty focus their scholarly work on health policy development and implementation, and the center supports the Duke community by facilitating academic collaboration and by providing consulting services to the Duke University Medical Center. Address inquiries to David B. Matchar, M.D., Director, Center for Health Policy Research and Education, 125 Old Chemistry Building, Durham, North Carolina 27706.

Center for International Development Research

The Center for International Development Research is a key research and training organization of the Sanford Institute of Public Policy. The center offers the Program in International Development Policy (PIDP), a mid-career program providing from one semester to two years of training in policy analysis and problems related to sustainable economic development. Participants in the program—known as PIDP Fellows—represent diverse nationalities, academic interests and professional backgrounds. Most have at least five years of experience in a development related field.

The center's core faculty are drawn from a variety of academic disciplines, including economics, political science, environmental studies, public policy, business administration, and history. The center's training, research, and consulting agenda are international in scope, covering a broad range of development policy issues. For additional information, contact the Center for International Development Research, Duke University, Box 90237, Durham, North Carolina 27708-0237.

Center for International Studies

This center is the major coordinating unit in the university which stimulates dialogue and research on global issues. The center sponsors a number of faculty committees which consider major regions of the world and major analytical themes which are transnational in nature. As a U.S. Department of Education National Resource Center in International Studies, the center sponsors a series of courses on global issues of interest to graduate students. These courses, along with courses in the center's undergraduate major, Comparative Area Studies, also provide opportunities for teaching assistantships for graduate students in the humanities and social sciences. In addition, the center administers a limited number of dissertation awards and pre-dissertation travel grants to graduate students. For more information contact Dr. Josefina C. Tiryakian, Senior Coordinator of Programs, Center for International Studies, 2122 Campus Drive, Durham, North Carolina 27706.

Center for Mathematics and Computation in Life Sciences and Medicine

The Center for Mathematics and Computation in Life Sciences and Medicine was established in 1986 to meet the growing need for quantitative methods in the understanding of complex biological and medical systems. Many important research problems, both basic and applied, now require the collaboration of experimental biologists, mathematicians, and computer scientists. The purpose of the center is to facilitate such collaborations between researchers in different departments and institutions, as well as between academic and industrial laboratories. Address inquiries to Professor Michael C. Reed, Director, Center for Mathematics and Computation in Life Sciences and Medicine, Department of Mathematics, Duke University, Box 90320, Durham, North Carolina 27708-0320.

Center for Slavic, Eurasian, and East European Studies

The graduate school of Duke University offers a program leading to the A.M. and Ph.D. degrees in several disciplines (economics, history, literature, linguistics, and political science), with a concentration in Soviet and East European studies. Students are encouraged to utilize the libraries and facilities of both Duke and the University of North Carolina at Chapel Hill. The holdings of the two libraries in Russian and East European materials are substantial and complementary. Both libraries have a policy of purchasing all significant published works in Slavic history, economics, government, geography, literature, and linguistics. Other joint activities include periodic colloquia involving the personnel of the two institutions and distinguished visiting scholars.

Students must apply to the director of graduate studies in the department of the discipline in which they wish to specialize. The center administers a limited number of graduate fellowships, and offers an area studies certificate.

For more information, contact Professor Edna Andrews or Vladimir Treml, co-directors, Center for Slavic, Eurasian, and East European Studies, Center for International Studies, 2122 Campus Drive, Duke University, Durham, North Carolina 27706.

Center for Tropical Conservation

The Center for Tropical Conservation was established to focus the activities of Duke faculty who share a common concern for the human and environmental problems of the tropics. Disciplines represented include, among others, anthropology, botany, economics, forestry, history, political science, and zoology. The center serves to sponsor interdisciplinary courses, seminars, and workshops; to promote and coordinate research relevant to the sustainable development of natural resources; and to gather and disseminate pertinent information. Inquiries should be addressed to Professor John W. Terborgh, Director, Center for Tropical Conservation, 3705-C Erwin Road, Simons Building, P.O. Box 90381, Durham, North Carolina 27708-0381.

Center for Demographic Studies

The center promotes research and training in demographic studies. Its facilities, located at 2117 Campus Drive, include a population library, the Joseph J. Spengler Collection of publications and research materials, and extensive data resources. The center does not offer degrees; it promotes the pursuit of advanced degrees, with a specialization in population studies, through either the Department of Sociology or the Department of Economics. Predoctoral and postdoctoral fellowships are available from the National Institute on Aging sponsored training program in the Social and Medical Demography of Aging. The center's program provides opportunities for direct student participation in ongoing research projects. The program of extramural research stresses, but is not limited to, work in the demography of aging, health, mortality, fertility, and migration.

Inquiries for training opportunities may be directed to Dr. George C. Myers, Director, Center for Demographic Studies, 2117 Campus Drive, Durham, North Carolina 27706.

Program for the Study of Developed Shorelines

The Program for the Study of Developed Shorelines was established in recognition of a critical need for both academic programs and geological research on national coastal issues. The goal of the program is promotion of research, education, and publications concerned with oceanic shorelines already under development. A limited number of graduate research fellowships are available to both M.S. and Ph.D. candidates and postdoctoral support is available for individuals involved in appropriate research. The program is centered both within the Department of Geology and the School of the Environment. Fellows supported by the program must satisfy all departmental require-

ments. For more information contact Professor Orrin Pilkey, Director, Program for the Study of Developed Shorelines, Department of Geology, Duke University, Box 90228, Durham, North Carolina 27708-0228.

Council on Latin American Studies

The Council on Latin American Studies oversees and coordinates graduate education in Latin American studies, and promotes research and dissemination of knowledge about the region. Chaired by Dr. Deborah Jakubs, the council is made up of Latin Americanist faculty and staff members representing Arts and Sciences disciplines as well as the professional schools. The council sponsors two speakers series: one provides a forum for talks by Duke and UNC faculty and graduate students, the other organizes presentations by visiting Latin Americanists from throughout the U.S. and overseas. The council also runs an annual research and travel grant competition for graduate students and junior faculty with funding from the Tinker Foundation.

The council and the Graduate School offer a certificate in Latin American Studies to student in M.A. and Ph.D. programs who fulfill the following specific academic requirements:

1. six graduate courses on Latin America;
2. an approved thesis or departmental equivalent on a Latin American topic; and
3. a demonstrated reading knowledge of Spanish, Portuguese, or other language of the region.

Graduate students interested in obtaining a certificate in Latin American Studies should contact the Council Chair or Program Coordinator, Council on Latin American Studies, Center for International Studies, 026 Old Chemistry Building, Box 90255, Duke University, Durham, NC 27708-0255.

Program in Political Economy

The Graduate School offers a Certificate in Political Economy. The certificate is awarded to graduate students in the Departments of Economics and Political Science who successfully complete a series of courses designed to provide interdisciplinary training. Completion of the certificate should enable a student to teach and conduct research in the field of political economy. Work in this field should also be sufficiently compatible with the student's departmental training to enable students to present themselves on the market with the disciplinary credentials to secure an academic appointment.

To earn the Certificate in Political Economy, a student must successfully complete a minimum of five courses, three of which are to be drawn from the core courses and two from a specialized area. One of the three core courses and two of the five courses overall must be in economics, taken in the Department of Economics, the Fuqua School of Business, or the Institute of Public Policy. All of these courses must be at the graduate level, unless an exception is approved by the program director.

All students seeking the certificate are also required to complete successfully at least two courses within the following fields of specialization: Individual and Social Choice; Normative Political Theory and the History of Economic Thought; and Governments and Markets.

For additional information, contact Professor Robert H. Bates, Duke University, Department of Political Science, 214 Perkins Library, Durham NC 27706, 919/684-6189.

Medical Historian Training Program

The Medical Historian Training Program is conducted under the auspices of the School of Medicine and the Graduate School. The M.D.-Ph.D. program requires a minimum of six years of graduate and medical study, and the M.D.-A.M. four or five years, depending on the use of summer terms. The M.D.-Ph.D. program is intended for

those students who know that their major career effort will be in teaching and other scholarly activities in the history of medicine (not necessarily to the total exclusion of clinical medicine). The M.D.-A.M., on the other hand, is appropriate for those who are undecided, but who wish to acquire a firm foundation for future study. In both programs the first two years and the last year will be spent in the medical school. All requirements for the Ph.D. and the A.M. must be completed before the final year of the M.D. program.

Application and Admission Procedures. Applicants must meet the requirements for admission to the School of Medicine and the Graduate School in the Department of History including the MCAT and GRE exams. Those candidates holding the M.D. degree will be considered for the Ph.D. and the A.M. degrees. Candidates who have completed two years of medical school will also be considered for either degree.

Applicants should complete and submit an application to the Graduate School for admission to the Department of History.

Additional information may be obtained by writing to Dr. Peter English, Box 3675 Duke University Medical Center, Duke University Durham, North Carolina 27710.

Medical Scientist Training Program

The Medical Scientist Training Program, conducted under the auspices of the Graduate School and the School of Medicine, is designed for students with a strong background in science who are motivated toward a career in the medical sciences and academic medicine. It provides an opportunity to integrate graduate education in one of the sciences basic to medicine with the clinical curriculum of the School of Medicine. The program usually requires six to seven years of study and leads to both the M.D. and Ph.D. degrees. Although the special emphasis of this program is on basic medical science, the trainees, because of their education in clinical medicine, have a remarkable range of career opportunities open to them. Graduates of this program generally follow one of two broad paths. Some directly pursue careers in teaching and research in one of the basic medical sciences, while maintaining strong ties with clinical science as a result of their combined training; others enter residency programs before pursuing investigative and teaching careers in clinical medicine, carrying with them strong academic backgrounds in the basic sciences.

Eligibility. Applicants must meet the admission requirements of both the Graduate School as a candidate for the Ph.D. degree and the School of Medicine as a candidate for the M.D. degree. Most candidates apply for admission to the first year of the program, but applications are sometimes accepted from students who are enrolled in appropriate stages of their curriculum in the Graduate School or School of Medicine of Duke University. In addition to the minimum requirements for acceptance in the Graduate School and the School of Medicine, advanced course work in science and mathematics as well as prior research experience count heavily in the selection of candidates.

Financial Support. Students admitted to the first year of the program can receive a traineeship award, consisting of a stipend and full tuition allowance, provided by a grant from the National Institutes of Health. The present annual stipend is \$11,000. Current policy of the National Institutes of Health limits the duration of the traineeship to six years, but the years need not be consecutive; this permits curricula which take more than six years. For those students requiring more than six years, the department and/or preceptor of the student provide support for additional years in training.

This traineeship, created by the National Research Service Award Act of 1974 (PL 93-348) provides (as do all research training awards under this act) for certain alternate service or payback requirements in the event that a research career is not pursued. Support by the NIH under the National Research Service Award Act requires the recipient to be a citizen or resident of the United States.

The Training Program. This program has been designed to offer trainees latitude in the selection of course material. Basic requirements are two academic years composed

of the first basic science year and the second clinical science year of the curriculum for medical students at Duke University. Following completion of the second year, the trainee enters the graduate program to complete the requirements for the Ph.D. degree. A final academic year of elective clinical study is necessary to complete the requirements for the M.D. degree. Both degrees are awarded at the completion of this sequence.

Additional information may be obtained by writing Professor Salvatore V. Pizzo, Medical Scientist Training Program, Department of Pathology, Box 3712 Duke University Medical Center, Durham, North Carolina 27710.

Oak Ridge Associated Universities

Duke University is one of the sponsoring universities of the Oak Ridge Associated Universities located at Oak Ridge, Tennessee. The graduate research program at Duke has available to it all the facilities of the Oak Ridge National Laboratory and the cooperative supervision of student research by the staff at Oak Ridge. Fellowships in several fields of science are available to qualified applicants.

Graduate Fellowship Program. On application by a university, ORAU awards fellowships to candidates for the master's and doctor's degrees. The student uses the fellowship to conduct thesis research in certain federal laboratories.

The application deadlines depend upon the fellowship. Further information may be obtained from the Office of Research Support, 01 Allen Building.

Office of Research Support

The Office of Research Support, located in 01 Allen Building, provides assistance to faculty members who seek external funding for research and other projects and to graduate students who seek graduate fellowships. The office houses a library of reference materials dealing with external funding. The ORS library contains fellowship and grant information for faculty, postdoctoral fellows, and graduate students from a variety of sources. It is arranged primarily by discipline and also includes such categories as "study abroad" and "dissertation support." Graduate students may take advantage of the resources of the office by browsing through the information on their own or they may make an appointment to talk with the staff by calling 684-3030. The office also reviews all grant proposals submitted to external funding sources, negotiates with the agency, and processes the award. Office hours are from 8:30-5:00 daily.

Center for Resource and Environmental Policy Research

The Center for Resource and Environmental Policy Research at Duke University is committed to the study of public policies on natural resources and the environment. Housed in the School of the Environment, the center promotes and coordinates research by faculty and students in the School of the Environment and other schools and departments at Duke and at other universities to provide a center of excellence for the analysis of contemporary resource and environmental policy issues. The center offers a forum for the examination of public and private responsibilities for natural resources and the environment and provides a means to link the specialized knowledge of academia with the information needs of government, industry, and international agencies.

Among the subjects now under study are land use models, valuation of forests and other natural resources, forest policy, and management of tourism in the United States and in developing countries.

For further information, write to the Center for Resource and Environmental Policy Research, Duke University, Box 90328, Durham, North Carolina 27708-0328.

Organization for Tropical Studies

Duke University is a member and the administrative home of an international consortium which provides leadership in education, research, and the wise use of natural resources in the tropics. The basic OTS course, *Tropical Biology: An Ecological Approach*, lasts for eight weeks (January-March and again in July-August). An eight-week course in *Tropical Managed Ecosystems* is also offered in July-August, and a three-week course, *Tropical Diversity*, is conducted in August. Similar courses are conducted in Spanish for Latin Americans.

Application information and forms, as well as fellowship applications for research travel and subsistence are available through the faculty representatives. Consult Professor William Ascher (political science) or Professor Daniel Richter (environment) for information.

Center for Research on Women

The Duke-UNC Center for Research on Women was founded in 1982 as a collaborative endeavor between Duke University and the University of North Carolina at Chapel Hill to promote women's studies scholarship and research throughout the tri-state area of North Carolina, South Carolina, and Virginia; to support curriculum development in women's studies; and to disseminate women's studies research and information throughout the South. The center's principal focus is to explore the interacting dynamics of gender, race, and class, with a particular emphasis on the American South.

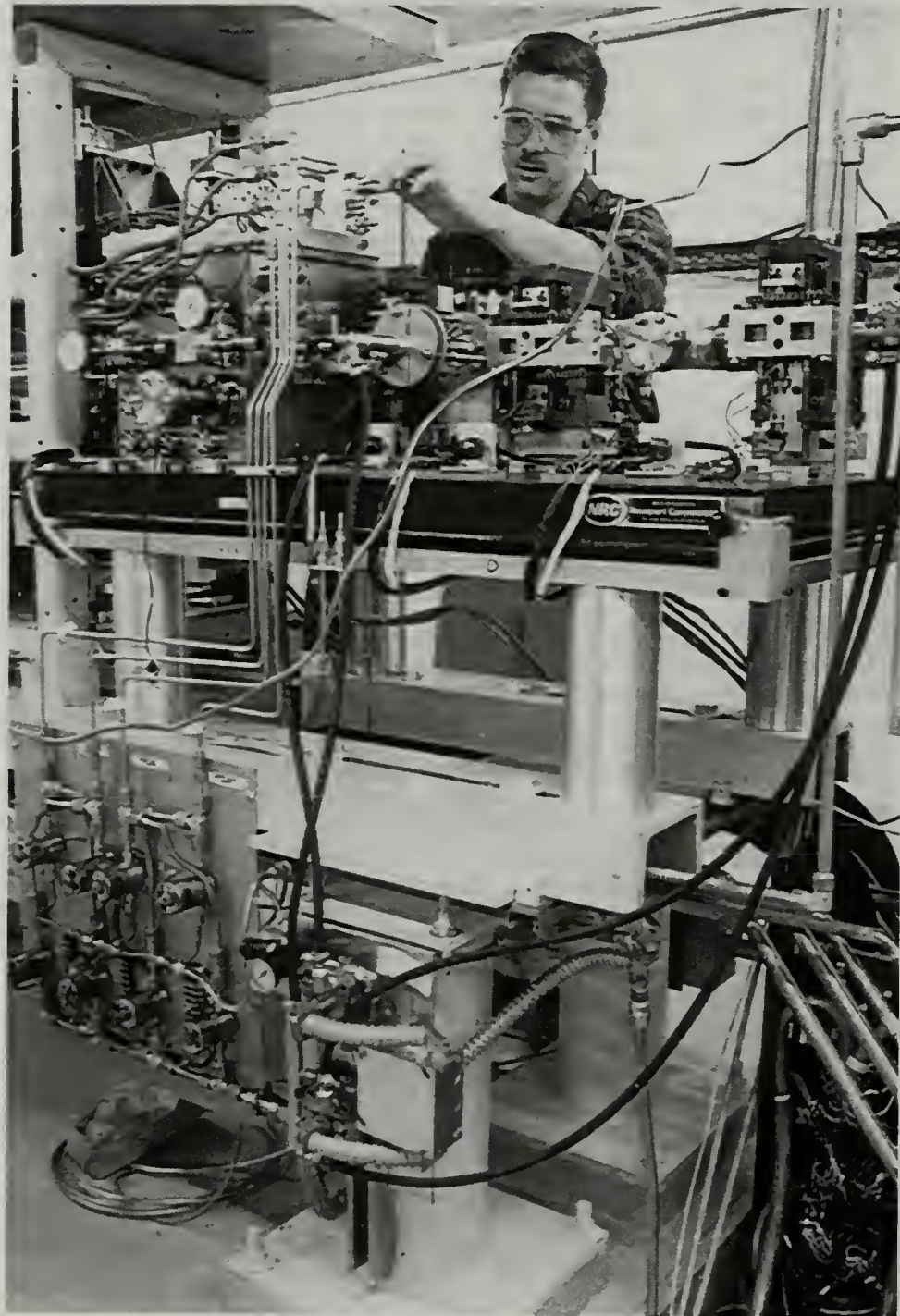
The center offers a limited number of unpaid visiting scholar affiliations, and opportunities for graduate student internships. Regular activities include an annual visiting lectureship series; a working paper series, *Southern Women: The Intersection of Race, Class and Gender*, published jointly with the research center at Memphis State University; the publication of a biannual newsletter, *Branches*; and sponsorship of conferences, colloquia, and community events.

The research center is located at 207 East Duke Building, (919) 684-6641, on the Duke campus, and at 03 Caldwell Hall 009A at UNC, (919) 966-5787. Dr. Jacquelyn Dowd Hall is the academic director and Christina Greene is the project director.

Program in Integrative Biology

The Program in Integrative Biology is an interdepartmental program that encourages students to think broadly and synthetically about problems of interest to biology, and to use the methods and approaches of several different biological disciplines in their solution. The program provides a counterpoise to the increasing narrowness of specialization that has characterized training in many subdisciplines of biology. Breadth of knowledge and an integrative approach to problem solving in such areas as development and evolution, systematics, functional morphology and biomechanics, neurobiology and behavior, and other cross-disciplinary fields, are established by close interaction with participating faculty members and by participation in seminars, workshops, and discussion groups. Graduate students in the program have access to research laboratories of the participating faculty members as well as such research facilities as the Morphometrics Laboratory, the Botany Greenhouses, the Fluid Flow Facility, the Primate Center, the Duke University Marine Laboratory, various vertebrate and invertebrate collections, the Botany Herbarium, the Duke Forest, and the Zoology Field Station. For more information, contact Professor Frederik Nijhout, Program in Integrative Biology, 226 Biological Sciences Building, Duke University, Durham, North Carolina 27706. (919) 684-2507 or (919) 684-3583.

Resources for Study



The Libraries

The libraries of the university consist of the William R. Perkins Library and its seven branches on campus: Biology-Forestry, Chemistry, Divinity, East Campus, Engineering, Music, and Mathematics-Physics; the Pearse Memorial Library at the Duke Marine Laboratory in Beaufort; and the independently administered libraries of Fuqua (Business), Law, and Medicine. In June 1992, these libraries contained over 4,100,000 volumes, 9.5 million manuscripts, and over 2 million public documents.

In addition to noteworthy holdings in British history, English literature, American history and literature, Commonwealth studies, Latin American history, religion, and science, the libraries include several distinguished special collections of international reputation such as the George Washington Flowers Collection of Southern Americana, the Baker Collection of Wesleyana and British Methodistica, the Mazzone Collection of Italian Literature, the Perez de Velasco Collection of Latin American History, the Jantz Collection of German Baroque Literature and German Americana, the Trent Collection of Walt Whitman, the Trent Collection in the History of Medicine, the Strisower Collection of International Law, and the J. Walter Thompson Advertising Archives.

THE WILLIAM R. PERKINS LIBRARY

Collections. The William R. Perkins Library, the main library of the university, houses most of the books and journals in the humanities and social sciences, large files of United States federal and state documents, public documents of many European and Latin American countries, publications of European academies and learned societies, and special collections from South Asian, Far Eastern, and Slavic countries. The newspaper/microform collection, with over 700,000 microform pieces and several thousand bound volumes, has several long eighteenth-century files; strong holdings of nineteenth-century New England papers; antebellum and Civil War papers of North Carolina, South Carolina, Virginia, and Georgia; as well as many European and Latin American papers. The manuscript collection of approximately 9.5 million items is particularly strong in all phases of the history, politics, and social and economic life of the South Atlantic region and includes significant papers in English and American literature and the J. Walter Thompson Advertising Archives. The collection in the Rare Book Room contains scarce and valuable materials covering a broad range of fields. Its Latin and Greek manuscripts constitute one of the outstanding collections of its kind in the United States, and the collection of Confederate imprints is one of the largest in the country.

The Reserves and Media Department houses the required reading materials placed on reserve for most graduate and undergraduate courses as well as the Paul B. Williams Media Center. This state-of-the-art facility contains videocassette players, laser disk players, and the audiovisual collection of films and videocassettes. The branch libraries serve the academic disciplines bearing their names. The Lilly Library on East Campus, however, contains a small general and reference collection, as well as the university's principal collections of art and art history materials.

Since the libraries at Duke, the University of North Carolina at Chapel Hill, and North Carolina State University are joined by a computer network, members of the Duke community can easily and quickly determine what books and other library materials are held by UNC and NCSU. Through a reciprocal borrowing agreement, faculty and students at Duke may borrow materials from both of these libraries.

Reference librarians are on duty in Perkins Library for most of the hours the library is open. Their primary responsibility is to assist patrons in making the most effective use of library collections and facilities. In addition to answering specific questions, the reference librarians also help patrons access information by identifying and explaining the use of library sources and by giving formal and informal instruction to groups of students, faculty, or staff. Professional reference service is available to students in all other campus libraries.

The library has both microfilming and copying services. The rules with regard to copyright and a schedule of fees for reproduction services are available in the library at the point of service.

Information on reference services, closed and open carrels, and interlibrary loans is available in the library.

THE MEDICAL CENTER LIBRARY

The Medical Center Library, located in the Seeley G. Mudd Communications Center and Library Building, provides services and informational resources necessary to further educational, research, and clinical activities in the medical field. In addition to the faculties and students in the Schools of Medicine, Allied Health, and Medical Center graduate departments, the library serves the professional and technical staffs of Duke Hospital as well as other health professionals throughout North Carolina. Over 260,000 volumes are available; approximately 3,000 journal subscriptions are received currently, in addition to extensive back files of older materials. Professional reference librarians are available for assistance in the use of library resources, and arrangements may be made for individual or group tours, instruction, or specialized seminars.

The History of Medicine Collections, including the Josiah C. Trent Collection, consist of rare books and manuscripts and a supporting group of histories, biographies, bibliographies, pictures, and ephemeral materials. The rare books are available to all, but are restricted to library use. Most modern books may be borrowed. The History of Medicine Collections also include the Duke Authors Collection, which preserves an archival copy of each book published by a member of the Duke medical faculty. The Frank Engel Memorial Collection consists of a small group of books for leisure reading in nonmedical subjects, supplemented by several newspapers and popular magazines. A reserve collection of heavily used books and journals is maintained in the Medical Sciences Branch Library located in the Nanaline Duke Building and covers the fields of biochemistry, genetics, pharmacology, and physiology.

THE SCHOOL OF LAW LIBRARY

The School of Law Library, with over 430,000 volumes, serves both the university and the local legal community. It features comprehensive coverage of basic Anglo-American primary source materials, including nearly all reported decisions of federal and state courts, as well as current and retrospective collections of federal and state codes and session laws. Digests, legal encyclopedias, and other indexing devices provide

access to the primary documents. A large section of the library collection is devoted to treatises on all phases of law and legal sciences, as well as history, economics, government, and other social and behavioral sciences relevant to legal research. The treatises are organized in the Library of Congress classification system and are accessible through a public catalog. Special treatise collections are maintained in several subject areas, including the George C. Christie collection in jurisprudence and the Floyd S. Riddick collection of autographed senatorial material. The library is a selective depository for United States government publications, with concentration on congressional and administrative law materials. The library receives the records and briefs from the United States Supreme Court, the Fourth Circuit Court of Appeals, and the North Carolina Supreme Court and Court of Appeals. In addition to its Anglo-American holdings, the library holds substantial research collections in foreign and international law. The foreign law collection is extensive in coverage, with concentrations in European law and business law materials. The international law collection is strong in primary source and treatise material on both private and public international law topics. Undergraduate and graduate students whose course of study requires access to legal literature may use the library. However, access to the library may be restricted during certain times because of accreditation standards.

MUSIC LIBRARY AND MUSIC MEDIA CENTER

The Music Library, located in Room 113 of the Mary Duke Biddle Music Building, and the Music Media Center, located in room 027 of the same building, are administered as a single branch library within the Perkins Library system. The Music Library contains a rapidly expanding collection of scholarly reference materials, books on music, music scores, and over 200 journals in the field. The Music Media Center contains facilities for listening to compact discs, cassettes, LP recordings, and for viewing laser discs, videotapes, and microforms. All recordings may be used within the center.

UNIVERSITY ARCHIVES

The Duke University Archives, the official archival agency of the university, collects, preserves, and administers the records of the university having continuing administrative or historical value. The institutional archives, which also include published material, photographs, papers of student groups and faculty, and selected memorabilia, are available for research under controlled conditions in 341 Perkins Library.

Science Laboratories

Computer ASSIST Center. For a contemporary university, extensive computing resources are essential. At Duke, the Computer ASSIST Center is the organization that works in partnership with members of the university community to enable them to achieve their goals through computing.

The Computer ASSIST Center provides access to a variety of computing facilities and services. Through Duke's connection to the Internet data network, students can access the Cray Y-MP/432 at the North Carolina Supercomputing Center and other national supercomputer sites. Mainframe service for Duke is provided on an IBM ES/9000 computer at the Duke University Computation Center (DUCC) located in the North Building.

Access to these supercomputer, mainframe, and minicomputer systems is provided by campus facilities connected by telecommunications links. These include some of the MS-DOS, Macintosh, and workstation clusters described below. In addition, anyone with a personal computer, modem, and telephone line can connect to these computers by dialing into a central dataswitch, or by connecting their computer to the new high-speed data network, DukeNet, where available.

The Computer ASSIST Center also supports extensive personal computer and workstation services located throughout the campus. There are three laboratories of MS-DOS based personal computers housed in the North, Engineering, and West Duke buildings, and thirteen public clusters of both MS-DOS and Apple Macintosh personal computer systems spread throughout the university. The six workstation laboratories contain DEC equipment and are located in North, Sociology-Psychology, Biological Sciences, Carr, and Engineering buildings. All laboratories and clusters are equipped with either dot matrix or laser printing facilities, and several are connected to the campus telecommunications network. While there is a nominal charge for the use of the laser printers, there is no charge for the use of the personal computers.

Funds for using the Duke mainframe come from outside grants and contracts, and from university funds. Several schools within the University, such as Arts and Sciences and Engineering, may apply for funding specifically designated for use at Duke. Faculty and graduate students within these schools may apply for a Duke account. Any student may request a free account for electronic mail services on the workstation system. More specific information regarding Duke computing facilities may be obtained by contacting the Computer ASSIST Center consulting desk at 660-BYTE, 9:00 A.M. to 5:00 P.M., Monday through Friday.

Botanical and Zoological Laboratories. Facilities for graduate study in the Departments of Botany and Zoology are located on the West Campus. The Biological Sciences Building contains well-equipped modern laboratories for teaching and research in the fields of botany, forestry, and zoology. Special facilities include animal rooms, greenhouses, darkrooms, refrigerated and controlled-environment laboratories, scanning and transmission electron microscopes, a Van de Graaf accelerator, X-ray machines, radiation and radioisotope equipment, a computerized morphometrics laboratory, and other modern research facilities. Extensive facilities for experimentation in environmental control of plant growth are available in the phytotron adjacent to the botany greenhouses.

The herbarium contains approximately 700,000 specimens and includes notable collections of mosses and lichens. Other assets for teaching and research are the Sarah P. Duke Gardens on the West Campus; the eleven-acre experimental plot and field laboratory developed by the Department of Botany; the Duke Forest, comprising 7,700 acres of woodland adjacent to the West Campus; the field station for the study of animal behavior and ecology; and the Duke University School of the Environment Marine Laboratory, an interdepartmental facility located on a small island on the coast at Beaufort, North Carolina, where twenty-two buildings and a small flotilla of ships and boats provide teaching and research facilities for resident graduate students and faculty as well as visiting individuals or groups.

Duke University, through the botany and zoology departments, is a member institution of the Organization for Tropical Studies, Inc., a consortium of universities with field station facilities in Costa Rica that provide opportunities for course work and research in tropical science.

Highlands Biological Station. Duke University holds a contributing membership in the Highlands Biological Station at Highlands, North Carolina, on the southern edge of the Blue Ridge Mountains at an elevation of 4,118 feet. The station and the region offer an excellent opportunity for field studies and some laboratory work. A limited number of qualified students in botany and zoology may make arrangements to carry out research here. Scholarships for advanced study during the summer months are available through the station.

For further information contact Dr. M. D. Rausher, Department of Zoology, Duke University, Durham, North Carolina 27706.

The Phytotron. The phytotron, a national environmental control facility operated for the National Science Foundation, is adjacent to the Biological Sciences Building and



is administered by the botany department. The phytotron is an integrated series of plant-growth rooms, chambers, and greenhouses, with forty-six separately controlled environments providing more than 4,000 square feet of plant-growing space. The factors of the environment controlled in the units to study plant growth include light, temperature, nutrients, carbon dioxide concentration, and humidity. By using the conditions in various day and night combinations, an exceptionally large number of environments can be simulated for testing the growth responses of plants. The phytotron also includes research laboratories and facilities for studying and monitoring the physiological processes of plants as they respond to global environmental change.

Research space in the phytotron is available to graduate students and faculty at Duke and to members of other educational and research organizations. For information concerning the rental of research space, contact Newton McQuay, Assistant Director of the Phytotron, Department of Botany, Duke University, Durham, North Carolina 27706.

Duke Forest. The Duke Forest comprises approximately 7,700 acres of land in five major divisions and several smaller tracts. A ten-minute walk from campus will take one well into many parts of the Durham division, and a network of roads and fire trails make almost all areas of the forest easily accessible.

The forest lies primarily in Durham and Orange counties, near the eastern edge of the piedmont plateau, and supports a cross-section of the woodlands found in the upper coastal plain and lower piedmont of the Southeast. A variety of timber types, plant species, soils, topography, and past land use conditions are represented. Elevations range from 260 to 760 feet. Soils of the region are derived from such diverse parent materials as metamorphic rock of the Carolina slate formation, granite, Triassic sedimentary rock, and basic intrusives.

The forest serves for research in such areas as forestry, zoology, botany, and ecology by faculty and students at Duke and neighboring universities. Background information useful to researchers covers such features as soils, topography, inventory, plantation and cultural records, as well as a bibliography of past and current studies. Current work on problems associated with developmental pressures at the urban-rural interface and integrated approaches to natural resource management have multiplied the value and benefit of the forest. For information contact: Judson Edeburn, Duke Forest Resource Manager, Room 206-A Biological Sciences Building, Duke University, Box 90332, Durham, North Carolina 27708-0332.

Forestry Sciences Laboratory. The Forestry Sciences Laboratory of the USDA Forest Service, Southeastern Forest Experiment Station is located in the Research Triangle Park near Durham. This research organization provides excellent opportunities to complement research conducted by students in the School of the Environment. Specialized research projects in timber investment opportunities, market efficiency, forest soils, insect toxicology, air pollution impacts, and the economics of forestry in developing countries are currently under way at the laboratory. The staff of the laboratory is available for consultation and participation in seminars. Arrangements may be made for students to conduct certain aspects of their research at the laboratory.

Marine Laboratory. The School of the Environment Marine Laboratory, an inter-departmental training and research facility of the university, is located on Pivers Island within the Outer Banks, adjacent to the historic seacoast town of Beaufort, North Carolina, with direct access to the Atlantic Ocean, Cape Lookout National Seashore Park, estuaries, sand beaches, wetlands, and coastal forests. Because of the dynamic collisions of offshore currents, the area provides an excellent opportunity for marine study and research. The laboratory accommodates nearly 3,700 visitors per year, including fifteen to twenty resident graduate students who are involved in year-round activities. (For additional information concerning the graduate program, refer to the section on marine sciences in the chapter "Courses of Instruction" in this bulletin and the current *Bulletin*

of Duke University: School of the Environment and the Marine Laboratory 1993 publication.) The physical plant consists of twenty-three buildings, including classroom laboratories, six research buildings, four dormitories, a maintenance complex, and a dining hall. The laboratory has skiffs, the R/V *Susan Hudson* training vessel with the capacity to perform small-scale biological, chemical, geological, and physical oceanography, and a 135-foot research and training vessel, the R/V *Cape Hatteras*, which is operated by the Duke/UNC Oceanographic Consortium.

For information concerning teaching and research space, write to the Personnel and Auxiliaries Office, Duke University School of the Environment, Marine Laboratory, Beaufort, North Carolina 28516-9721.

Zoology Field Station. The Zoology Field Station, located less than one mile from campus, provides facilities for the study of penned, free-ranging, and caged animals in a protected wooded area of eighty acres with two ponds. For information regarding research space, write to the Chairman, Department of Zoology, Duke University, Durham, North Carolina 27706.

Primate Center. The Duke University Primate Center is located in Duke Forest about two miles from the main campus. The colony is composed of approximately 550 prosimian primates representing thirteen genera, twenty-two species, and twenty-eight varieties. This is both the largest and most diversified colony of living lower primates in the world and the world's largest conservation center for primates. The center also houses frozen, preserved, and fossil primate collections. These collections and animals are utilized by faculty members and both graduate and undergraduate students in the Departments of Biological Anthropology and Anatomy, Environment, Geology, Psychology, and Zoology for all qualified researchers in primate paleontology, prosimian aging, locomotion, cytogenetics, comparative anatomy, behavior, and physiology. Applications for graduate study in one of these areas should be directed to the director of graduate studies of any of the five departments. For information pertaining to the use of the Primate Center, graduate studies, or availability of research space, write to Dr. Kenneth E. Glander, Director, Duke University Primate Center, 3705 Erwin Road, Durham, North Carolina 27705.

The Vivarium. The vivarium and related satellite facilities are maintained to support research and teaching programs of Duke University. The central vivarium contains forty-four animal housing rooms, four sterile operating rooms, two necropsy rooms, ten project rooms, and a diet kitchen. A farm facility is also available. The vivarium and related facilities are staffed by veterinarians, technicians, and caretakers to assure humane care and treatment of animals. Duke University is accredited by the American Association for the Accreditation of Laboratory Animal Care which assures compliance with standards of NIH.

Experimental Psychology Laboratories. The facilities of the Department of Psychology: Experimental include those appropriate for the study of human and animal behavior. There are especially equipped laboratories for human memory, operant conditioning, visual and taste physiology and psychology, speech processing, visual observation of infants' and young children's social interactions. Laboratories are well supplied with micro- and minicomputers for word processing, data analysis, and experimental control. Fully equipped machine, woodworking, and electronics shops which are staffed by full-time technicians. Additional facilities for research and teaching are available in the laboratories and clinics of the adjacent Duke Medical Center, in the nearby Veterans Administration Medical Center, and in other area universities and research companies.

Chemistry Laboratories. The Department of Chemistry is housed in the Paul M. Gross Chemical Laboratory, a building containing 146,000 square feet of total area. This well-equipped chemical laboratory provides conditions conducive to research in many

areas of current interest. Nuclear magnetic resonance facilities include a broad band Varian XL-300, General Electric QE-300, Gn-300 (25 mm wide bore probe) and GN-500 frequency adjustable instruments, a JEOL FX-90Q, and two 60MHz proton instruments. An ESR spectrometer, the Varian E-9, provides an excellent facility for research in electron spin resonance. Mass spectrometric service is provided by a Hewlett-Packard GC-MS system with HPLC/MS capacity, as well as access to a VG-70S high resolution MS with MS/MS capability. X-ray diffraction cameras of all types are available, along with Enraf-Nonius CAD-3 and CAD-4 automatic diffractometers. Numerous instruments of varying sophistication for photoacoustic, fluorescence, infrared, routine FTIR, dispersive infrared, UV, Raman and ORD-CD spectroscopy are available; various laser sources, monochromators, and computerized data acquisition systems are associated with these systems. Some other significant research facilities include T-jump, stopped flow and diode array spectrometers for rapid kinetic studies, a circularly polarized luminescence spectrometer, and an ultra dry lab facility. A variety of preparative and analytical gas and liquid chromatographs are also located in the building and a number of analytical applications of robotic systems are employed. Research in biological chemistry is facilitated by the availability of an autoclave, media prep room, high speed centrifuges, and ultra centrifuges.

Computing facilities in the Department of Chemistry include a VAX 8350 with an associated tape drive and two 456 megabyte Winchester mass storage devices which operate in a multiuser FORTRAN environment. An Evans and Sutherland PS 390 and Tektronics graphics terminals are connected to the system as well as a cluster of DEC terminals. Clusters of Apple Macintosh, IBM, and AT&T PCs, and Sun workstations are also available. The departmental VAX system and many other computers associated with specific research groups are networked via Ethernet, which is linked to the university fiber optic network. Among the resources available via the network are Duke's IBM 4381 mainframe and the North Carolina Supercomputer Center's Cray Y-MP 8/432.

The department has a machine shop and an electronics shop, and has access to the university glass-blowing shop. The facilities of the Duke University Marine Laboratory on the coast at Beaufort, North Carolina, are available for specimen collecting and processing studies of organic chemicals of marine origin. The Department of Chemistry Library, with holdings of approximately 45,000 volumes, is also located in the Paul M. Gross Chemical Laboratory. The library receives 375 current scientific periodicals, 275 serial subscriptions and has a computer facilities for complete information retrieval.

Physics Laboratories. The Physics Building houses research and instruction in the Departments of Physics and Mathematics. Additional space is provided by the adjacent Nuclear and Free Electron Laser Laboratory Buildings. Graduate students studying in these two departments usually have offices in these buildings.

About half of the physics space is devoted to research laboratories for the department's programs. Special equipment includes: picosecond, dye, carbon dioxide, and far infrared lasers; a 45-MeV electron linear accelerator driving an infrared free electron laser (FEL) and a 1 GeV linear accelerator and high current electron storage ring driving an ultraviolet to soft X-ray FEL; a high-resolution 3 MeV Van de Graaff accelerator; a 16 MeV tandem Van de Graaff accelerator with polarized source and cryogenically-cooled polarized targets; a helium liquefier, cryostats, magnets, and associated equipment for research in the millikelvin temperature range; VAX computers for data collection and processing in nuclear physics and in high-energy physics; various mini-computers and microcomputers in the research groups; a cluster of seven NeXT computers for instructional/research use; and a Sun minicomputer for general departmental use.

The Mathematics-Physics Library is located in the Physics Building; it contains a large selection of books and scholarly periodicals. Also located in the building are

instrument and electronics shops, staffed by instrument makers and electronics technicians.

Engineering Research Laboratories. The laboratories of the four departments of the School of Engineering contain extensive basic equipment that may be applied in several specialized fields. The facilities available for instruction and research are suggested by the following brief listing of equipment found in each department:

Biomedical Engineering. Biomechanics laboratories: hydraulic testing system, IBM PS/2 microcomputer, micro VAX II computer, optical displacement measuring system, silicon graphics/GE graphcon system, Sun micro systems SPARC station, Zonic modal analyzer. Biomedical materials and surface interactions laboratories: air- and water-cooled Argon lasers, air convection oven, capillary rheometer, FTIR infrared spectrometer, gamma counter, gel permeation chromatograph, Langmuir-Blodgett trough, liquid nitrogen cooled CCD camera, Nikon inverted microscope with phase contrast and epifluorescence, Ultime image analysis system and Macintosh II, vacuum oven, Zeiss axioplun microscope, electrophysiology and neurophysiology instrumentation. Ultrasound imaging and transducer laboratories; CAD/CAM stations for circuit development, diamond tip dicing saw, high-speed video system, image processing system, laminar flow hood, multiple PCs and work station, PC board maker, ultrasound mechanical scanner, VAX 11/780.

Civil and Environmental Engineering. Faculty in civil and environmental engineering routinely design, construct, and adapt laboratory equipment for specialized teaching and research tasks in engineering mechanics, environmental engineering, geomechanics, structural engineering, transportation and systems engineering, and water resources engineering. In addition, arrays of standard laboratory facilities are available to support each research area.

Research and teaching facilities in engineering mechanics, structural engineering, and geomechanics include four independent closed-loop electrohydraulic dynamic loading systems (MTS), with a frequency range up to 100 Hz, and ranges of load to capacity 6,000, 35,000, 50,000 and 220,000 lbs. The 6,000 lbs. actuator can develop a constant crosshead speed up to 50,000 in./min. Equipment is available for fabricating specimens and testing fiber-reinforced polymer composites. An environmental chamber tests in the temperature range of -100° to +350° F; equipment for spectral and modal dynamic analysis, and an ultra-high pressure triaxial shear apparatus is available for confining pressures up to 100,000 psi. Rock-testing facilities, model-testing equipment for anchored walls and penetrometer studies, a large-aperture research polariscope, a reflective photoelastic polariscope, and a sustained-loading facility for long duration in studies of prestressed concrete are routinely used in teaching and research procedures.

Research and teaching facilities in environmental engineering include wet and dry laboratories equipped to study a range of physical, chemical, and biological processes. A fully integrated resource recovery pilot plant, calorimetry for the measurement of heat values of secondary fuels, air classifiers interfaced with computer monitors, as well as indoor and outdoor water resources monitoring devices including flumes, venturi meters, and digital computation hardware are available. The biotechnology and physical-chemical laboratories are equipped with autoclaves, a media preparation room, walk-in environmental rooms, numerous fume hoods, a biohazard containment facility for cultivation of genetically engineered microorganisms, fully instrumented bioreactors with on-line control, and various analytical instrumentation including liquid scintillation counting, autoradiography, atomic adsorption spectroscopy, total carbon analysis to ppb levels, gas chromatographs equipped with ECO, FID, and TCD detectors, HPLCs, computer-assisted image analysis microscopes, and a recently acquired fourier transfer infrared spectrometer facility.

Computer resources available to civil and environmental engineering students in general and transportation and systems engineering students in particular include a multitude of personal computers, three Digital Equipment Corporation Workstation

clusters consisting of fifty workstations in total, and an IBM 4381 mainframe. Most of the computer resources are networked with the School of Engineering's ethernet backbone and are easily accessible from several locations in the department and across the campus. Depending on the specific application, students can successfully investigate problems in computational fluid mechanics, rigid-body dynamics, particle and mathematical optimization as well as transportation and environmental systems engineering research topics. If additional computing capabilities are needed, access to the Microelectronics Center of North Carolina's Cray YMP vector processing supercomputer is available. Numerous software packages are available to students through the existing Computational Resource Center. Many problems addressed by the faculty and students of the Department of Civil and Environmental Engineering are computationally complex and could not be approached without the substantial computing facilities available at Duke.

Electrical Engineering. Digital data processing laboratory equipped with the IBM RS-6000 as a multi-user computer operating in a UNIX type environment for interactive design, graphics, computation, and computer-aided engineering; Digital Equipment Microvax work stations for VLSI design; ethernet network for connection to regional, national, and international data networks; Signal Processing Laboratory with Sun workstations; microwave facilities for experimentation up to 35 GHz; robotics with a GE P-50 robot; microprocessor laboratory; Digital Systems Laboratory; solid-state power conditioning laboratories with dedicated computers for controlling instruments, including digital processing oscilloscopes and network and impedance analyzers, and for computer-aided design; clean room and semiconductor nMOS fabrication laboratory for integrated circuits; a molecular beam epitaxy laboratory for III-V compound semiconductor crystal growth using a Riber Model 3R&D MBE system; access to the design, fabrication, and research facilities of the Microelectronics Center of North Carolina; and an ion implanter and MOCVD epitaxial growth system in a III-V compound semiconductor lab at the Research Triangle Institute.

Mechanical Engineering and Materials Science. The department has a number of well-equipped laboratories for studies in aerodynamics, acoustics, nonlinear dynamics and chaos, convective heat transfer, computational fluid mechanics and heat transfer, control theory, cell and membrane biomechanics, bioprocess engineering, biorheology, polymer engineering, corrosion, electronic materials, physical metallurgy, positron annihilation spectroscopy, and expert systems. Equipment in these laboratories includes a wind tunnel, a scanning electron microscope, a scanning tunneling microscope, spectrometers, a positron annihilation system and diffusion furnace, inverted microscopes, low-light-level video cameras and a photon counter, cell-culture systems, an anechoic chamber, a dynamic signal analyzer and laser velocimeter for bearing analysis, an X-ray generator and diffractometer, and a fluorescence microscope. A variety of computational equipment is available including a mini-supercomputer connection to a regional supercomputer.

F. G. Hall Hypo-Hyperbaric Center. The F. G. Hall Hypo-Hyperbaric Center contains eight hyperbaric and/or hypobaric pressure chambers used to simulate altitude or deep-sea diving conditions, for the purpose of both experimentation and medical treatments. The interconnected steel chambers can simulate depths of 3,600 feet, or altitude of 155,000 feet, a capability unmatched in the United States. In 1982 a research dive to 2,250 feet set a new world's record. Research of this type has led to the development of safer and faster decompression tables, better breathing mixtures, and improved types of diving equipment together with new treatments for diving accidents and diseases treated with high-pressure oxygen. The laboratory provides opportunities for basic and applied research and for training physicians, postdoctorates, and graduate students in pressure-related medicine and physiology. The program is multidisciplinary with major participation by the Departments of Anesthesiology, Medicine, Surgery, Cell Biology, Neurobiology, and the School of Engineering.

The Medical Center. Currently the Medical Center at Duke University occupies approximately 140 acres on the West Campus. The southern quadrant is contiguous with the main quadrangle of the university and consists of the following: Davison Building, Duke Hospital South, Baker House, Barnes Woodhall Building, Diagnostic and Treatment Building, Ewald W. Busse Building, Eugene A. Stead Building, Clinical Research II, and the Edwin A. Morris Clinical Cancer Research Building.

The northern portion includes the Joseph and Kathleen Bryan Research Building for Neurobiology, Nanaline H. Duke Medical Sciences Building, Alex H. Sands Medical Sciences Building, Edwin L. Jones Basic Cancer Research Building, Clinical and Research Laboratory Building, Bell Building, Seeley G. Mudd Communications Center and Library, Joseph A. C. Wadsworth Building (Eye Center), Duke Hospital North Division and Anlyan Tower, and Lenox Baker Hospital.

In the western section of the campus are: Surgical Oncology Research Building; Environmental Safety Building; Research Park Buildings I, II, III, and IV; the Vivarium; and the Cancer Center Isolation Facility.

In the eastern section of the campus are Pickens Rehabilitation Center, Civitan Mental Retardation and Child Development Center, and Trent Drive Hall.

Student Life



Living Accommodations

Duke University has two residential apartment facilities in which graduate and professional students live. These apartments are available for continuous occupancy throughout the calendar year. All of the apartments are completely furnished by the university. An itemization of furnishings is included with the floor plans sent out in the application bulletin. Spaces in apartments for single students are provided on an individual basis with each student paying rent per academic term to the university. This method permits students to share apartments with others of their choice. When this is impractical, the Department of Housing Management strives to place persons with similar interests together.

Town House Apartments. Town House Apartments, located about three blocks from the main East-West Campus bus line, is a thirty-two-unit complex. These apartments are more spacious than most apartments found on campus or in Durham. Because of its location away from the academic facilities, students find that it offers a change from normal campus life and activities.

Each air-conditioned apartment includes a living room, a master bedroom, a smaller bedroom, a bath and a half, and an all-electric kitchen with a dining area. Spacious closets and storage spaces are provided within each apartment. A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months.

All utilities—water, heat, air-conditioning, gas, and electricity—are provided. Occupants must make arrangements with the local telephone company, GTE, to pay for telephone service. GTE usually requires a deposit when initial application for service is made. The company should be contacted prior to arrival as it usually takes several days to obtain service.

Central Campus Apartments. During 1975, Duke University completed a 500-unit apartment complex. A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months. Additional facilities include a pub, convenience store, tennis courts, and basketball courts.

All utilities—water, heat, air-conditioning, and electricity—are provided. Telephone jacks are provided in each apartment. Duke University's Tel-Com supplies telephone

service. Central Campus Apartments residents are responsible for providing their own phones and having them connected.

Efficiency, two-bedroom, and three-bedroom apartments are rented to graduate students. Efficiency units are very limited in number and are generally not available to new students.

Application Procedures. When students are informed of their acceptance to Graduate School they will also receive a postcard on which to indicate preference for university housing. This postcard should be returned to the Department of Housing Management. Detailed information on the types of accommodations and application forms will be forwarded to the accepted student. Assignment to all university housing is made on a first-apply, first-assigned basis, and it is not guaranteed.

Off-campus Housing. The Department of Housing Management maintains a listing of rental apartments, rooms, and houses provided by property owners or real estate agencies in Durham. These listings are available in the department only; during the summer an assistant is available to answer questions and aid students in their attempt to obtain housing off campus. Information on commercial apartment complexes in the Durham area may be obtained by indicating a preference for off-campus housing on the postcard which you will receive with your acceptance notice. Except for assuring that owners sign a statement of nondiscrimination, off-campus property is in no way verified and neither the University nor its agents negotiate between owners and interested parties.

The search for accommodations should begin as soon as possible after acceptance to the Graduate School. A visit of two or three days will allow you the opportunity to make use of the off-campus service and to inspect personally the available facilities.

Duke University Marine Laboratory. The Duke University Marine Laboratory, located on Pivers Island, has cottage-type residence halls which are available. Further information may be obtained from the publication *Marine Laboratory* 1993.

Dining Services

Graduate students are encouraged to dine on campus at any Duke Dining Services (DUS) facility. Dining Services provides cafeterias, restaurants, fast food operations, delis, snack bars, ice cream/dessert shops, and catering services in convenient locations throughout campus.

On West Campus, students are invited to dine in the Blue & White Room (cafeteria), the University Room (cafeteria), the Oak Room (restaurant), the Cambridge Inn (deli, hot foods, salad bar, and dessert shop), the Rathskeller (hamburgers, pasta, and sandwiches), the Boyd-Pishko Cafe (fast foods), and Lick's (ice cream/frozen yogurt). On East Campus, visit the East Food Court (a collection of food shops including a grill, oriental food station, salad bar/healthy food shop, pasta area, deli, pizza station, and a dessert/ice cream shop), the East Union Cafeteria, and the Upper East Side (snack shop). North and Central Campus food service locations include Trent Cafe (hot foods, grill, sandwiches, and desserts) and The Pub on Central Campus (specialty sandwiches, salads, and beverages).

Food purchases may be paid for any one of three ways: by using cash, a dining account, or a flexible spending account. Both the dining account and the flexible spending account allow a student to make purchases on campus by accessing a prepaid account carried on the student identification card, or Duke Card. Information about these Duke Card accounts is available from the Duke Card Office, 024 West Union Building, Durham, NC 27708-0911, (919) 684-5800.

Further information about campus dining service facilities and dining plan options is available from Duke Dining Services, 029 West Union Building, Durham, NC 27708-9088, (919) 660-3900.

Services Available

Student Health Program. The Duke Student Health Program is administered by the Department of Community and Family Medicine, Duke University Medical Center. Medical services are provided by board-certified family physician faculty, physician assistants, and nurse-practitioners.

The Duke Family Medicine Center (684-6721), located on the corner of Erwin Road and Trent Drive, is the primary location for medical care. Students are seen by appointment Monday-Friday, 8:00 A.M.-7:30 P.M., Saturdays from 10:00 A.M.-1:30 P.M., and Sundays from 2:00 P.M.-4:30 P.M. A wide variety of services are available: medical care, GYN clinic, health education, sports medicine, laboratory, pharmacy, travel and immunization, x-rays, cold/flu self-help table, allergy clinic, and nutrition counseling.

Students are encouraged to use the Duke Family Medicine Center as their portal of entry to other health resources when needed, including the specialty clinics at Duke University Medical Center. This will help with coordination of appropriate care.

For problems arising after hours, students should call the Infirmary (684-3367). After consulting with the physician on call, the nurse may advise the student to come to the Infirmary or to the Duke Emergency Department (684-2413) for further evaluation. In the event of an obvious life-threatening emergency, students should directly to the Emergency Department. If necessary, Duke Public Safety (call 911 or 684-2444) will provide on-campus transportation to the Emergency Department or the Infirmary.

The Infirmary (684-3367), located on the fourth floor of Duke University Hospital-South Division, Purple Zone, provides inpatient treatment of illnesses too severe to manage in the residence hall or apartment, but not requiring hospitalization.

The Health Education component of Student Health is headquartered at the Trent Drive Hall (684-3620, ext. 325). Health education staff are available, by appointment, to assist students in making informed decisions that promote their health. Topics of concern include alcohol and other drug usage, eating and nutrition, sexually transmitted diseases, stress management, and others. Health education staff are also available on a drop-in basis at the Healthy Devil Health Education Center, Room 113, House 0 in Kilgo quad on West Campus. Free, confidential pregnancy testing and pregnancy options counseling is also available there, by appointment (684-3620, ext. 325).

Sports Medicine Services: The Student Sports Clinic is located on West Campus, in the basement of Card Gym. A physical therapist is available from 3:00-6:00 P.M. weekdays, on a walk-in basis, to assess exercise-related problems, and to outline short-term treatment plans to aid recovery, and help prevent reinjury. The Sports Medicine Clinic is located on the third floor of the Finch-Yeager Building adjacent to Wallace Wade Stadium. There students may be seen by a Student Health physician, by appointment (684-6721).

Counseling and Psychological Services (CAPS; 660-1000), is a complementary service to the Student Health Program. Mental health and career counseling services are available, as detailed in the CAPS brochure.

Confidentiality. Information regarding the physical or mental health of students is confidential, released only with the student's permission.

Health Fee. All currently enrolled full-time students and part-time degree candidates are assessed a Student Health Fee. This covers most services rendered within the Student Health Program (see below) during each enrolled semester. An optional Summer Health Fee for students not enrolled in summer session is also available through the Bursar's Office.

Health insurance is essential to protect against the high cost of unexpected illnesses or injuries which would require hospitalization, surgery, or the services of specialists outside the Student Health Program. All students are strongly encouraged to be certain that they have such insurance. For those not adequately covered by other insurance, the Duke Student Insurance Plan is specifically designed to complement the coverage

provided by the Student Health Fee. Coverage for the student's spouse and dependent children may also be purchased. Further information about this plan may be obtained from the Student Insurance Office (684-6455) or from Hill, Chesson, and Associates (489-7426).

Services Covered by the Health Fee. The health fee covers most of the services at Duke Family Medicine Center if medically indicated and rendered by a student health provider:

- Medical care for acute and chronic illness, and minor injuries;
- One annual health maintenance examination and associated studies;
- Routine laboratory and X-ray services;
- Medications on the approved formulary, as required for short-term treatment of nonchronic conditions;
- Immunizations required for programs receiving academic credit at Duke (a supplemental fee may be required for certain immunizations), excluding pre-matriculation immunizations.

The health fee covers a variety of other services at Duke Family Medicine Center and other locations:

- Health education and health promotion including nutrition consultation;
- Sports medicine, excluding specialists' (orthopaedic) services;
- Infirmary service, excluding meals and diagnostic testing order by specialist consultants;
- Mental health and career counseling at CAPS.

Services not Covered by the Health Fee. If you unsure whether a service is covered, please ask one of the Student Health staff prior to receiving service. You are financially responsible for the following:

- Medical care provided in the Emergency Department, hospital, or other nonstudent health facility;
- Dental care;
- Pregnancy care or deliveries;
- Tests, procedures, prescriptions not medically indicated or those ordered by non-Student Health providers;
- Immunizations required for entrance to Duke or other universities, or for personal travel,
- Medications required for long-term use and contraceptives.

Upon arrival on campus, all students receive a detailed brochure about the program and the services covered by the Student Health Fee.

Career Development Center. The mission of the Career Development Center is to educate the students of Duke University in the arts of self-assessment, career exploration, career planning, and job hunting with the goal of helping them develop rewarding and fulfilling careers. The center primarily serves the students and alumni of Trinity College, the School of Engineering, and the Graduate School.

Career counselors are on staff to help students at Duke begin the process of discovering career interests. Career specialists help students focus on specific career fields, including the arts, business, community service, education, engineering, mathematics, computer science and the physical sciences, government, health and life sciences, higher education, international careers, and mass media. The career specialist for graduate student concerns provides specific information and advice to graduate students interested in pursuing academic and nonacademic careers.

Programs and services of the center include the credential service, which collects and sends letters of recommendation, the video interviewing program which offers interview training, the on-campus recruiting program offering interviews for permanent positions with a wide variety of national organizations, and DukeSource providing access to alumni/ae advisors in a wide variety of disciplines.

The Career Spectrum, a weekly career newsletter, is designed to keep students aware of current career-related opportunities on- and off-campus. Announcements of job openings, career seminars, workshops, and information sessions are announced each week. The Career Library and Resource Room provide a wealth of printed and database materials on specific career fields and specific employers. CareerSource, an online computer career database, provides information at computer clusters located throughout the university and is available until midnight on weekdays and twenty-four hours a day over the weekends. Using CareerSource, a student may review bulletins, information about the center, review summer and full-time job listings, and register to participate in center programs.

The Office of Continuing Education also offers career development services, with both individual consultations and group workshops. The office provides help with resume preparation and offers guidance tests, including the Myers-Briggs Type Indicator, a test of personality preferences that allows students to better understand their own personalities, gain insight into differences they experience with others, and begin to look at career fields that fit their personality preferences. The office does charge a fee for these services. For more information, please call 684-6259.

Student Affairs

Cocurricular Activities. Graduate students at Duke University are welcome to use such university recreational facilities as swimming pools, tennis courts, the golf course, and to affiliate with the choral, dance, drama, music, and religious groups. They may become junior members of the American Association of University Professors and may affiliate with Phi Beta Kappa and social fraternities.

A full program of cultural, recreational, and religious activities is presented by the Office of Cultural Affairs, the Duke University Campus Ministry, the Duke University Union, the Office of Student Activities, and recreational clubs. The Duke University Union sponsors a wide range of programs through its committees, which are open to all segments of the campus community. Included are touring Broadway shows; rock, jazz, and pop concerts; speakers; films; a film-making program; the largest fully student-run television station in the country; art exhibits in three galleries; and a broad program in crafts located in Southgate Dormitory and the Bryan University Center. The Aquatic Center and the East Campus Gymnasium pool are available to students, faculty, and staff families. The handball, racquetball, squash, and tennis facilities and the weight room on East and West Campus are also available. Interested students may participate in softball and other team sports.

The University Center complex includes the Bryan University Center, which houses the Information Center, two drama theaters, a film theater, lounges, stores, meeting rooms, games room, the Rathskeller, art gallery, and other facilities; the West Union, which includes dining facilities; and Flowers Building, which includes student publications, Page Auditorium, and the university box office.

Inquiries should be directed to the Recreation Office, 105 Card Gymnasium; the Office of Cultural Affairs, 109 Page Building; Duke Chapel; the Duke University Union, Bryan University Center, or the Office of Student Activities, Bryan University Center.

Full information regarding the scheduling of major events and programs for the entire year will be found in the *Duke University Yearly Calendar*; detailed and updated information for the fall and spring semesters in the *Duke Dialogue*, available each Friday; updated information for the summer session in the *Summer Session Calendar*, published at the beginning of each summer term; and the *Duke Chronicle*, published each Monday through Friday during the fall and spring and each Thursday during the summer. Copies of the Duke University calendars may be obtained at the information desk, Bryan University Center, or the calendar office, Page Building. Also during the summer, the

Summer Session Calendar is published weekly by the summer session office and is available at convenient locations.

Graduate and Professional Student Council. The Graduate and Professional Student Council is the representative body for the students of graduate departments and professional schools. The council provides a means of communication between schools and between graduate students and the administration. The council selects graduate students for membership on university committees. Representatives of each department and officers of the council are selected annually.

Religious Life. The Duke University Chapel, open from 8:00 A.M. until 10:00 P.M., provides a magnificent setting for daily prayer and meditation. In addition, a variety of worship experiences are provided throughout the week including the university service of worship at 11:00 A.M. each Sunday, noonday prayer each weekday during term, and choral vespers each Thursday at 5:15 P.M. The 150-voice Chapel Choir is open by audition to all interested singers. The Graduate and Professional Student Fellowship, sponsored by Duke Chapel, provides ecumenical fellowship as well as service opportunities for interested students. Duke Campus Ministry also invites graduate students to participate in the various religious life groups. Contact the office of Dean of the Chapel or the Assistant Dean of the Chapel, Duke Chapel, for further details.

Visiting Scholars

The libraries and other facilities of Duke University are made available, to the extent practicable, to faculty members of other colleges and universities who wish to pursue their scholarly interests on the Duke campus. Such visitors are not charged unless they wish to participate in activities for which a special fee is assessed. Inquiries pertaining to visiting scholars should be addressed to the department chairman concerned or the dean of the Graduate School.

Postdoctoral Research

Scholars engaged in postdoctoral research often find it advantageous to use the resources of Duke University during the summer. The university welcomes these visitors and makes living accommodations available to them during the summer sessions from May 9 to August 8. Persons desiring research privileges (library and/or laboratory) should request approval through the department in which the research interests lie or through the Graduate School.



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The information in the bulletin applies to the academic year 1993-94 and is accurate and current, to the best of our knowledge, as of February, 1993. The university reserves the right to change programs of study, academic requirements, lecturers, teaching staffs, the announced university calendar, and other matters described in the bulletin without prior notice, in accordance with established procedures.

Information that the university is required to make available under the Student Right to Know and Campus Security Acts may be obtained from the Office of University Relations at 684-2823 or in writing to 615 Chapel Drive, Duke University Durham, NC 27706

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School of Medicine Calendar 1993-94

First Year (Freshmen) Students

Fall Term 1993

August	
11	Wednesday, 8:30 a.m.—Orientation
16	Monday, 8:00 a.m.—Begin Block I and 1993-94 academic year
October	
7	Thursday, 6:00 p.m.—End Block I
12	Tuesday, 8:00 a.m.—Begin Block II
November	
23	Tuesday, 6:00 p.m.—Begin Thanksgiving holiday
29	Monday, 8:00 a.m.—Classes resume
December	
17	Friday, 6:00 p.m.—End Block II and Fall 1993 Term

Spring Term 1994

January	
3	Monday, 8:00 a.m.—Begin Block III and Spring 1994 Term
17	Monday—Martin Luther King, Jr. holiday
28	Friday, 6:00 p.m.—End Block III
31	Monday, 8:00 a.m.—Begin Block IV
April	
8	Friday, 6:00 p.m.—Begin spring vacation
18	Monday, 8:00 a.m.—Classes resume. Begin Block V
June	
17	Friday, 12:00 noon—End Block V and 1993-94 academic year

Second Year (Sophomore) Students

Introduction to Clinical Diagnosis 1993

July	
12	Monday, 8:00 a.m.—Begin classes
August	
27	Friday, 12:00 noon—End classes

Fall Term 1993

August	
30	Monday, 8:00 a.m.—Begin classes in sections 81 and 41
September	
6	Monday, Labor Day holiday
22	Wednesday, 6:00 p.m.—End classes in section 41
27	Monday, 8:00 a.m.—Begin classes in section 42
October	
20	Wednesday, 6:00 p.m.—End classes in sections 81 and 42
25	Monday, 8:00 a.m.—Begin classes in sections 82 and 43
November	
17	Wednesday, 6:00 p.m.—End classes in section 43
22	Monday, 8:00 a.m.—Begin classes in section 44
24	Wednesday, 6:00 p.m.—Begin Thanksgiving holiday
29	Monday, 8:00 a.m.—Resume classes in section 44
December	
18	Saturday, 6:00 p.m.—End classes in section 82 and 44

Spring Term 1994

January	
3	Monday, 8:00 a.m.—Begin classes in sections 81 and 41
17	Monday—Martin Luther King, Jr. holiday
26	Wednesday, 6:00 p.m.—End classes in section 41
31	Monday, 8:00 a.m.—Begin classes in section 42
February	
23	Wednesday, 6:00 p.m.—End classes in sections 81 and 42
28	Monday, 8:00 a.m.—Begin classes in sections 82 and 43
March	
23	Wednesday, 6:00 p.m.—End classes in section 43
28	Monday, 8:00 a.m.—Begin classes in section 44
April	
6	Wednesday—Registration for Fall Term 1994, rising third and fourth year students
20	Wednesday, 6:00 p.m.—End classes in sections 82 and 44. Begin spring vacation

Summer Term 1994

May	
2	Monday, 8:00 a.m.—Begin classes in sections 81 and 41
3	Tuesday—Late registration for Fall 1994 Term, rising third and fourth year students
25	Wednesday, 6:00 p.m.—End classes in section 41
30	Monday, 8:00 a.m.—Begin classes in section 42
June	
22	Wednesday, 6:00 p.m.—End classes in sections 81 and 42
27	Monday, 8:00 a.m.—Begin classes in sections 82 and 43
July	
4	Monday, Independence Day holiday
20	Wednesday, 6:00 p.m.—End classes in section 43
25	Monday, 8:00 a.m.—Begin classes in section 44
August	
17	Wednesday, 6:00 p.m.—End classes in sections 82 and 44

Third Year (Junior) and Fourth Year (Senior) Students Summer Term 1993

May	
10	Monday, 8:00 a.m.—Begin classes in sections 16, 81, 41
June	
5	Saturday, 12:00 noon—End classes in section 41
7	Monday, 8:00 a.m.—Begin classes in section 42
July	
3	Saturday, 12:00 noon—End classes in sections 81, 42
4	Sunday—Independence Day holiday
5	Monday, 8:00 a.m.—Begin classes in sections 82, 43
31	Saturday, 12:00 noon—End classes in section 43
August	
2	Monday, 8:00 a.m.—Begin classes in section 44
28	Saturday, 12:00 noon—End classes in sections 16, 82, 44

Fall Term 1993

August	
30	Monday, 8:00 a.m.—Begin classes in sections 16, 81, 41
September	
6	Monday, Labor Day holiday

25	Saturday, 12:00 noon—End classes in section 41
27	Monday, 8:00 a.m.—Begin classes in section 42
October	
23	Saturday, 12:00 noon—End classes in sections 81, 42
25	Monday, 8:00 a.m.—Begin classes in sections 82, 43
27	Wednesday—Registration for Spring Term, 1994
November	
20	Saturday, 12:00 p.m.—End classes in section 43
22	Monday, 8:00 a.m.—Begin classes in section 44
23	Tuesday—Late registration day for Spring Term, 1994
24	Wednesday, 6:00 p.m.—Begin Thanksgiving holiday
29	Monday, 8:00 a.m.—Classes resume in section 44
December	
21	Tuesday, 12:00 noon—End classes in sections 16, 82, 44

Spring Term 1994

January	
10	Monday, 8:00 a.m.—Begin classes in sections 16, 81, 41
17	Monday—Martin Luther King, Jr. holiday
February	
5	Saturday, 12:00 noon—End classes in section 41
7	Monday, 8:00 a.m.—Begin classes in section 42
28	Monday—Registration for Summer Term 1994—rising fourth year students
March	
5	Saturday, 12:00 noon—End classes in sections 81, 42. Begin spring vacation
14	Monday, 8:00 a.m.—Classes resume. Begin classes in sections 82, 43
25	Friday—Late registration day for Summer Term 1994. Third Year Curriculum Plans due in dean's office
April	
6	Wednesday—Registration for Fall Term 1994—rising third and fourth year students
9	Saturday, 12:00 noon—End classes in section 43
11	Monday, 8:00 a.m.—Begin classes in section 44
May	
3	Tuesday—Late registration day, Fall Term, 1994
7	Saturday, 12:00 noon—End classes in sections 16, 82, 44
7-8	Saturday-Sunday—Graduation activities

Summer Term 1994

May	
9	Monday, 8:00 a.m.—Begin classes in sections 16, 81, 41
June	
4	Saturday, 12:00 noon—End classes in section 41
6	Monday, 8:00 a.m.—Begin classes in section 42
July	
2	Saturday 12:00 noon—End classes in sections 81, 42
4	Monday—Independence Day holiday
5	Tuesday, 8:00 a.m.—Begin classes in sections 82, 43
30	Saturday, 12:00 noon—End classes in section 43
August	
1	Monday, 8:00 a.m.—Begin classes in section 44
27	Saturday, 12:00 noon—End classes in sections 16, 82, 44

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General Information



History

I have selected Duke University as one of the principal objects of this trust because I recognize that education, when conducted along sane and practical, as opposed to dogmatic and theoretical, lines is, next to religion, the greatest civilizing influence.

I have selected hospitals as another of the principal objects of this trust because I recognize that they have become indispensable institutions, not only by way of ministering to the comfort of the sick, but in increasing the efficiency of mankind and prolonging human life.

James Buchanan Duke, Indenture of The Duke Endowment, 1924

By establishing the Duke Endowment, James Buchanan Duke expressed his hope that adequate and convenient hospital care would become available to all Americans. His further bequests provided for the opening, in 1930, of the School of Medicine, School of Nursing, and hospital which today are the core institutions of the Duke University Medical Center. By opening the first major outpatient clinics in the region in 1930, Duke recognized its responsibility for providing quality care to the people of the Carolinas. The Private Diagnostic Clinic, organized in 1932, not only provided coordinated medical and surgical care to private patients with moderate incomes but also allowed members of the medical faculty to contribute a portion of their earnings toward the continued excellence of medicine at Duke. In less than five years Duke was ranked among the top 25 percent of medical schools in the country by the Association of American Medical Colleges.

Building on this heritage, the Duke University Medical Center ranks among the outstanding health care centers of the world. Its pioneering medical curriculum, instituted in 1966, features a generous measure of elective course selection in the belief that all health professionals must be prepared for a lifetime of self-education. The scientific grounding for that education is provided through participation in a wide variety of ongoing research programs. The opening of Duke Hospital North in 1980 makes the Duke Hospital, with 1,048 beds, one of the most modern patient care facilities anywhere available. The combined strength of its teaching, research, and hospital care programs represents the continuing fulfillment of the dream of James Buchanan Duke.

Over the years the Medical Center has been enlarged and its programs expanded by new construction and by the acquisition of, and affiliation with, established hospitals.

Currently the Medical Center at Duke University occupies approximately 140 acres on the West Campus. The southern quadrant is contiguous with the main quadrangle of the university and consists of the following: *Davison Building*—Department of Pathology, Central Teaching Facility, Division of Audiovisual Education, Medical Center Administration, Student Lounge, School of Medicine, Office of Admissions, and departmental research laboratories and offices. *Duke Hospital South*—inpatient care units, in- and outpatient diagnostic, treatment and support services including laboratories, positron emission tomography imaging, nursing service administration, amphitheater, chapel, private diagnostic clinics, outpatient clinics, student infirmary, departmental offices; *Baker House*—Departments of Medicine, Anesthesiology, Obstetrics and Gynecology, outpatient diagnostic, treat-

ment and support services including speech and hearing, pastoral care and counseling, and dentistry/oral surgery; *Barnes Woodhall Building*—inpatient care units, in- and outpatient diagnostic, treatment and support services including labor and delivery room and radiology, hospital administration, Department of Radiology, departmental offices; *Diagnostic and Treatment Building*—clinics, in- and outpatient diagnostic, treatment and support services, departmental research laboratories and offices; *Ewald W. Busse Building*—Center for the Study of Aging and Human Development, treatment and support services, departmental research laboratories and offices; *Eugene A. Stead Building*—inpatient care unit (research), departmental research laboratories and offices; *Clinical Research II*—hyperbaric medicine unit, departmental research laboratories and offices, clinical cancer research unit and the Department of Psychiatry; *Edwin A. Morris Clinical Cancer Research Building*—Clinics, diagnostic treatment and support services including Department of Radiation Oncology, departmental research laboratories and offices.

The northern quadrant has the following buildings: *Joseph and Kathleen Bryan Research Building For Neurobiology*—Departments of Neurobiology, Pharmacology, Radiology, and the Alzheimers Disease Research Center; *Nanaline H. Duke Medical Sciences Building*—Departments of Biochemistry, Cell Biology and Pharmacology; *Alex H. Sands Medical Sciences Building*—Departments of Cell Biology and Biological Anthropology, and Anatomy, and basic science research programs of the Departments of Medicine, Surgery, Psychiatry, and Anesthesiology; *Edwin L. Jones Basic Cancer Research Building*—Director of Comprehensive Cancer Center, Departments of Microbiology and Immunology, Section on Cell Growth, Regulation and Oncogenesis, and basic science research programs of Medicine, Surgery, Pediatrics, Obstetrics-Gynecology, Radiology, and Pathology; *Clinical and Research Laboratory Building*—Howard Hughes Medical Institute, Section of Genetics, Hospital Clinical Laboratories, Departments of Medicine, Pharmacology and Psychiatry; *Bell Building*—offices and laboratories of Anesthesiology, Medicine, Surgery, Pediatrics, and Radiology. It also houses Information Services and the Gross Anatomy Laboratories; *Seeley G. Mudd Communications Center and Library*—Medical Center Library, the Trent Collection of the History of Medicine, the Office of Communications, Medical Center Bookstore, Office of Grants and Contracts, Continuing Medical Education Office, and the Searle Center for Continuing Education; *Joseph A. C. Wadsworth Building (Eye Center)*—inpatient care unit, eye clinic, diagnostic, treatment and support services including operating rooms, recovery, Department of Ophthalmology departmental research laboratories and offices; *Duke Hospital North Division and Anlyan Tower*—inpatient care units, diagnostic, treatment, and support services including operating rooms and recovery, labor and delivery suite, full term nursery, radiology, magnetic resonance imaging (MRI), laboratories, Departments of Medicine, Surgery, Obstetrics-Gynecology, Pediatrics, Radiology, and Anesthesiology departmental offices; *Lenox Baker Hospital*—inpatient care units and clinics for pediatrics.

In the western quadrant of the campus are: *Surgical Oncology Research Building*, *Environmental Safety Building*, *Research Park Buildings I, II, III, and IV*—offices and laboratories of Radiation Oncology, Medicine, Surgery, Pediatrics, Radiology, Microbiology and Immunology; *Vivarium*—Division of Laboratory Animal Resources and laboratory animal care facilities; *Cancer Center Isolation Facility*—special containment facility for cancer research.

In the eastern quadrant of the campus are: *Pickens Rehabilitation Center*—general and rehabilitation outpatient clinics; Student Health Service, Employee Health Service, and Faculty Family Health Service; *Civitan Mental Retardation and Child Development Center*—offices, clinics, and laboratories of Psychiatry and Pediatrics; *Trent Drive Hall*—Health Administration and Department of Community and Family Medicine.

The goal of the Duke University Medical Center is to be a leader in contemporary medicine. This involves maintaining superiority in its four primary functions: unexcelled patient care, dedication to educational programs, national and international distinction in the quality of research, and service to the region.

Growth is identified with deeper involvement in the social aspects of health, the establishment of advanced therapeutic and research facilities, and a medical teaching program that has attracted the attention of educators around the world.

Resources for Study

Library. The Medical Center Library is located in the Seeley G. Mudd Building, midway between the north and south Medical Center campuses.

The Medical Center Library attempts to provide informational services and collections necessary to further educational, research, and clinical activities in the health sciences. The collection of approximately 260,000 volumes and 3,000 current journal subscriptions is freely available for use by Medical Center students and personnel; study accommodations for 500 readers includes extensive provisions for audiovisual learning. The library also includes the Trent Collection which is unsurpassed in the southeast as a resource for study of the history of medicine, and a branch collection of books and journals maintained in the Nanaline B. Duke Medical Sciences Building.

The Medical Center Library is open: Monday-Friday, 8:00 A.M.-midnight; Saturday, 10:00 A.M.-6:00 P.M.; Sunday, 12:00 noon-midnight. Summer and holiday hours are as announced.

Director: Susan J. Feinglos, M.L.S. (McGill, 1972); Curator, Historical Collections: Suzanne Porter, M.L.S. (Columbia, 1966).

The Medical Center Bookstore offers a wide selection of biomedical textbooks and reference books, as well as an assortment of laboratory and clinical instruments and office supplies. Facilities for browsing in a pleasant atmosphere are available, as are special individualized services. The Bookstore is open 8:30 A.M.-5:00 P.M., Monday-Friday, 10:00 A.M.-4:00 P.M. Saturday.

Manager: Renee Million

The Searle Center for Continuing Education in the Health Sciences provides elegant accommodations for conferences, symposia, lectures and meetings to support the continuing education activities of the Medical Center and University. Provisions have been made for banquet and food service arrangements to complement the meeting facilities.

Director: John Finan

The Thomas D. Kinney Central Teaching Laboratory. The Thomas D. Kinney Central Teaching Laboratory is located on the fourth floor of Davison Building where it provides laboratory, demonstration, and conference space for all courses taught in the basic sciences, with the exception of gross anatomy. A full-time staff maintains a wide range of equipment and provides supplies and services necessary for the teaching programs in allied health as well as medical education. This enables the academic staff of each department to devote its efforts entirely toward the students.

Six unit laboratories, each accommodating sixteen to eighteen students, are devoted to instruction for the first year. All first year medical students are given space in one of these laboratories for their own work which they maintain for the entire academic year. Small laboratories are interspersed between the six unit laboratories and provide space for large pieces of equipment used in conjunction with exercises conducted in the unit laboratories. One large multipurpose laboratory (which can accommodate forty or more students) and one small room to accommodate twenty students provide space for a variety of teaching exercises. Other areas include demonstration and conference rooms and a microscopy laboratory for advanced courses offered during the third year. A computer cluster with word-processing software and patient simulations is available to students 24 hours a day; electronic mail is available; a 30-workstation computer laboratory is available for computer-assisted educational training for students, faculty and employees. Other services include in-house microscope cleaning and repair, exam grading for multiple-choice questions, and course evaluation tabulation.

Four large conference rooms in Duke South are scheduled through this office, providing additional teaching space for groups of 16 to 200 persons when necessary.

Manager: Carol G. Reilly, B.S.

Division of Audiovisual Education. The Division of Audiovisual Education serves the Medical Center by providing all types of audiovisual support materials to assist the faculty. There are three sections: Medical Art, Medical Photography, and Instructional Television.

The Medical Art Section provides illustrations produced by various art methods and techniques. Services rendered are surgical and anatomic drawings, schematic and mechanical drawings, diagrams, charts, graphs, designs, lettering, calligraphy, signs, and poster exhibits, as well as other forms of illustrations. Computer generated graphics and illustration are produced in the department and an extensive imaging service is offered for faculty and staff who create slides on desktop computer systems.

The Medical Photography Facility is staffed and equipped to provide a full range of photographic services for patient care, teaching, and research. Patient photography activity includes black and white and color photos in the studio, on the ward, in the clinic, or in the operating room. Copy photography includes a full range of slide services for internal and external lecture and presentation purposes. Black and white and color prints for publication, display and poster session purposes are also available. Other services include daily processing of color prints and of Ektachrome film, location photography, and passport and application prints.

Instructional Television also supports teaching, research, and patient-care programs of the Medical Center. The three-fourths inch U-matic and one-half inch VHS video formats are used for color recording of staff and patient education programs, lecture presentations, and surgical procedures as part of staff professional education. Other services include fully scripted videotape productions for promotional or information uses, instructional design and computed-based training. Audiotape services, projectionists, and projectors are available.

The Curriculum Materials Development project staff works with faculty to produce media materials such as slidetape programs, videotape productions, and computer-assisted instruction programs. These materials may be a regular part of course presentations or may serve as adjuncts to classroom activities.

Director: Thomas P. Hurtgen, M.B.A.

Duke Hospital. Duke Hospital, one of the largest private hospitals in the south, is part of the Medical Center and currently is licensed for 1,125 beds. The hospital directs its efforts toward the three goals of expert patient care, professional education, and service to the community. It offers patients modern comprehensive diagnostic and treatment facilities and special acute care and intensive nursing units for seriously ill patients. More than 36,000 patients are admitted annually. Surgical facilities include forty operating rooms in which surgeons perform more than 22,000 operative procedures annually. Approximately 2,200 babies are born each year in the delivery suite. Other special facilities for patients include a heart catheterization laboratory, hemodialysis unit, cancer research unit, pulmonary care unit, hyperbaric oxygenation chamber, and cardiac care unit.

Close working relationships with private and governmental health and welfare agencies provide opportunities for continued care of patients after they leave Duke Hospital.

Ambulatory services include the outpatient clinics, private diagnostic clinics, the employee health service, and the emergency department, with annual total patient visits of over 572,000. The clinical faculty of the Duke University School of Medicine participate in undergraduate and graduate medical education and practice medicine in the hospital and in private diagnostic clinics.

Duke Hospital, with a house staff of approximately 875, is approved for internship and residency training by the Council on Medical Education and Hospitals of the

American Medical Association and is fully accredited by the Joint Commission on Accreditation of Healthcare Organizations.

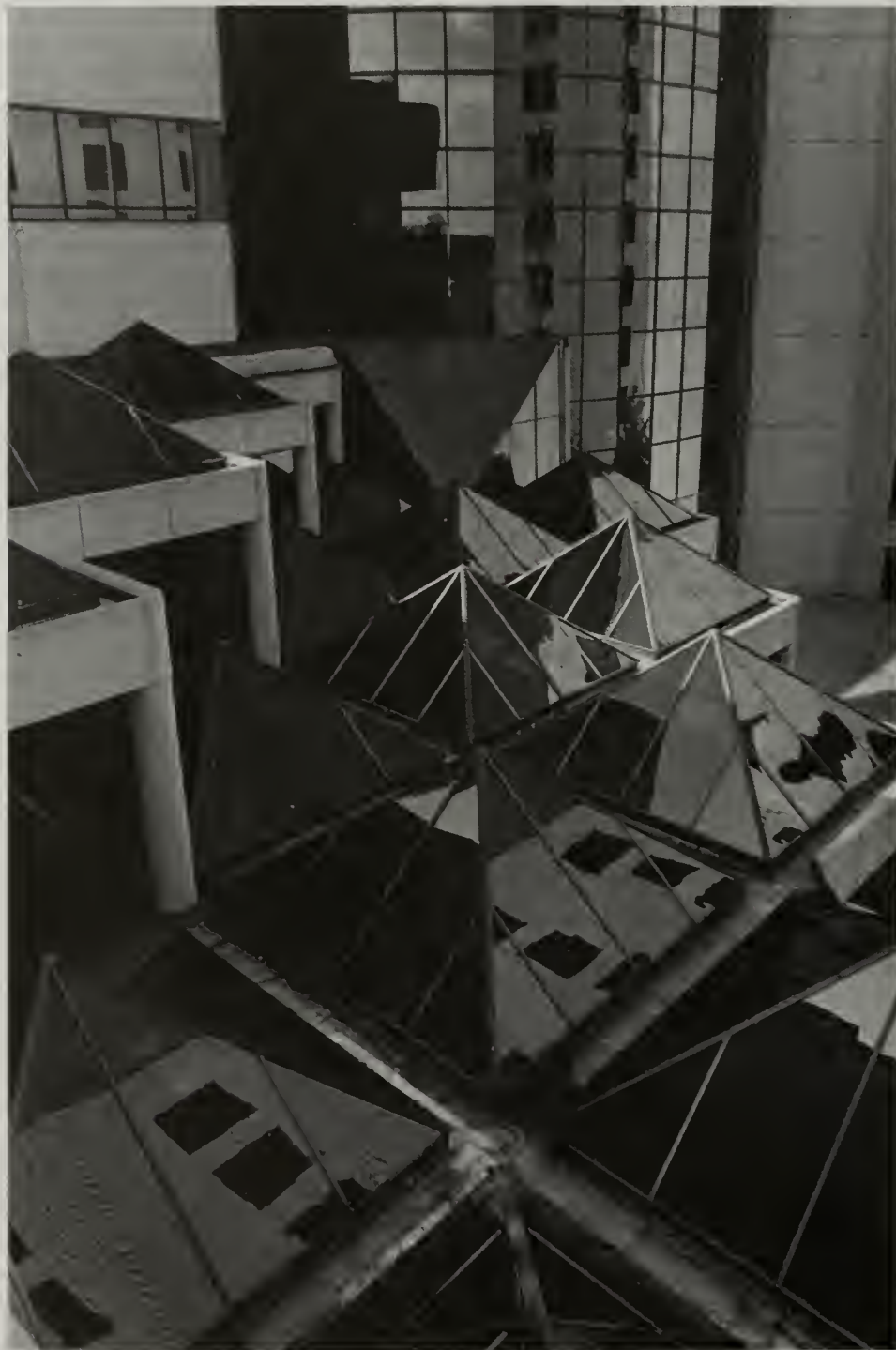
Veterans Affairs Medical Center. The Durham Veterans Affairs Medical Center, with 435 beds, annually admits over 7,000 patients. The hospital is within walking distance from the School of Medicine and has closely integrated teaching and training programs for medical students and house staff. These programs are provided by the full-time professional staff who are members of the faculty of Duke University School of Medicine.

Lenox Baker Children's Hospital. On November 1, 1987 the Lenox Baker Children's Hospital became a part of Duke University Medical Center, entering a new phase in its development as an orthopaedic and rehabilitation center for the children of North Carolina. A full spectrum of orthopaedic and rehabilitation services is offered to identify and meet realistic goals; and to educate, support, and assist families, schools, and communities in providing a rich environment for disabled children.

Durham Regional Hospital. Durham Regional Hospital is a county owned, 451-bed, general, short-term care community facility serving the residents of Durham County. This institution participates in many of the medical and health-related professional training experiences.

Other Hospitals. Various cooperative teaching and training programs are available for medical and allied health professional students and house staff at other hospitals including McPherson Hospital in Durham, Asheville Veterans Administration Medical Center in Buncombe County, John Umstead Hospital in Butner, Fayetteville Area Health Education Center in Fayetteville, and Cabarrus Memorial Hospital in Concord, North Carolina.

Program Information



Mission Statement and the Medical Curriculum

Physicians are experiencing profound changes in their understanding of disease and the delivery of medical care. These changes include: a broader scientific base for medical practice; a national crisis in the cost of health care; an increased number of career options for physicians; an emphasis on career-long learning in investigative and clinical medicine; the necessity that physicians work cooperatively and effectively as leaders among health care professionals; and the emergence of ethical issues not heretofore encountered by physicians. Medical educators must prepare physicians to respond to these changes, and the most successful medical schools will position their students to take the lead at the frontiers of medical investigation and health care delivery. Duke University School of Medicine is prepared to meet this challenge.

Continuing at the forefront of medical education requires more than that Duke graduates are trained in outstanding basic science, clinical research, and clinical programs for meeting the health care needs of society. It also requires addressing such concerns as national science and health policy, meeting the health care needs of society, providing medical care for the disadvantaged, and applying basic science discoveries to clinical medicine. As health care practices at the federal, state, institutional, and individual levels evolve, these endeavors need input from physicians uniquely prepared to assume guiding roles.

Duke University's role as a leader in medical education is built upon our internationally-recognized tradition of fostering scientific scholarship and providing excellent preparation for the practice of medicine. Our curriculum promotes creativity, scholarship, leadership and diversity, integrating the basic and clinical sciences and preparing students to pursue the spectrum of options available to modern physicians, from basic science to primary care.

The Duke faculty enhance the Medical School's traditional curricular approach by continually embracing new methods of education and evaluation so as to improve the medical education experience. Attention to curricular development assures Duke graduates that they are grounded in basic biomedical sciences, are competent and caring clinicians, are prepared to pursue a lifetime of continuing education, and are capable of participating in local, national, and international discussions about the future of health care.

Duke Medical School graduates are distinguished not only by their clinical skills and technological expertise, but also by their ability to think originally and creatively about the spectrum of biomedical science and practice of medicine. Features of the four-year curriculum that insure these goals include:

1. The development of a core curriculum which is rigorous, efficient, integrative, and realistic.
2. The integration of basic, clinical, and psychosocial information and skills throughout the four years of medical education.
3. A general introduction to basic and clinical science for two years, followed by two years of individualized curricular options that promote professional diversity and personal development.
4. The provision of basic and clinical experiences that strengthen personal initiative and provide opportunities to practice the scientific method in solving the problems of modern medicine.
5. The promotion of structured active learning that will include explicit experience in leadership and cooperative roles.
6. The mentoring of students by faculty in all facets of the learning process.
7. The implementation of a standardized and valid assessment of progress, carefully and thoughtfully evaluating the acquisition of knowledge, skills, and attitudes appropriate to the future goals of each student.
8. The incorporation of information technology and the use of computers into student learning and evaluation.
9. The researching and implementation of new and improved methods of teaching.

The curriculum, while offering a previously unattainable degree of flexibility to medical education and new opportunities for intellectual exploration, also makes heavy demands upon the student. It should be recognized that medical students at the Duke University School of Medicine are expected to maintain a consistent level of performance and to demonstrate qualities of initiative and dedication to their chosen profession. A scholarly attitude toward medicine that will continue throughout an entire career is an important objective of the medical school. The foundations of this attitude to learning should accompany the student upon entering.

Students are expected to maintain at all times a professional attitude toward patients, to respect confidences, and to recognize that they are the recipients of privileged information only to be discussed within the context of scholarship and in circumstances that truly contribute to the educational process or to the care of the patient. This attitude involves consideration not only of speech and personal appearance but also of morality, honor, and integrity.

Beginning in the fall of 1987, the School of Medicine greatly enlarged the focus on ethics and human values in the curriculum. In the face of major advances in medical technology and sciences, today's medical student must be prepared to deal with new complexities of medical practice. These advances and complexities also make it of paramount importance that medical education enable each student to grow in both depth and breadth as a human being. The Duke University School of Medicine is rising to this challenge.

Doctor of Medicine Degree

The degree of Doctor of Medicine is awarded, upon approval by the faculty of Duke University, to those students who have satisfactorily completed the academic curriculum; demonstrated the intellectual, personal, and technical skills to function as a competent physician; demonstrated their fitness to practice medicine by adherence to a high standard of ethical and moral behavior.

The faculty of Duke University School of Medicine have developed general guidelines for technical standards for medical school admissions and degree completion. These are available on request from the school.

The awarding of degrees is contingent upon payment of, or satisfactory arrangements to pay, all indebtedness to the university.

In May, 1990, the Duke University School of Medicine was fully accredited for seven years by the Liaison Committee on Medical Education of the Association of American Medical Colleges and the Council on Medical Education of the American Medical Association.

Course Requirements—First Year. The student studies the principles of all the basic science disciplines. Rather than mastering an encyclopedic array of facts, the purpose is to acquire familiarity with the major principles of each subject. In addition, the School of Medicine has developed a program offered in the form of a required course (Clinical Arts) that provides an opportunity for students to learn basic medical science through active self-learning centered in a clinical context. The year consists of instruction in the following:

Semester 1	Credit
Biochemistry	4
Genetics	2
Cell Biology	2
Microanatomy	2
Medical Physiology	4
Gross Human Anatomy	4
Clinical Arts	0
	<hr/> 18

Semester 2	Credit
Basic Neurobiology	4
Human Behavior	2
Microbiology	5
Immunology	2
Pharmacology	4
Pathology	5
Clinical Arts	0
	<hr/> 22

Following the first year, there is a vacation before the Introduction to Clinical Diagnosis course starts in the third week of July. Every class has Thanksgiving, Christmas, Martin Luther King, Jr. holiday, and spring break with the exact dates depending upon rotation and class schedules.

Course Requirements—Second Year. Satisfactory completion of the first year curriculum is a prerequisite to the second year curriculum. The second year provides an exposure to clinical science disciplines, which permits students early in their careers to become participants in the care of patients. The acquired appreciation of the problems of the clinical areas and the opportunities to recognize the applications of the basic sciences should lead to a more meaningful selection of courses for the subsequent two years.

The Introduction to Clinical Diagnosis course, which occupies the seven weeks preceding the core clinical rotations, is followed by eight-week rotations in internal medicine, surgery, obstetrics/gynecology, pediatrics, and psychiatry, and either an eight-week rotation in family medicine or a four-week rotation in family medicine and a four-week rotation in neurology.

Course Requirements—Third and Fourth Years. Satisfactory completion of the second year curriculum is a prerequisite to the elective curriculum. The third and fourth (elective) years of undergraduate medical education build upon the experience in basic

science and clinical medicine gained in the earlier years. The elective years consist of four semesters of sixteen weeks each. In addition, the fourth year has an optional summer term also of sixteen weeks. Successful completion of sixty-four elective credits (thirty-two basic science credits during the third year and thirty-two clinical science credits during the fourth) is required for graduation. Course offerings are described in the different departmental sections in this bulletin. The wide selection affords an opportunity for the student, with guidance from advisers, to design a program that best satisfies her or his needs.

Third Year. The purpose of the basic science experience, usually occurring in the third year, is to provide the student with an opportunity to focus in an area or areas of interest and to pursue, in depth, a scholarly activity. Time may also be spent gaining strength in areas of basic science weakness. Each student determines a home base study program for the basic science elective experience. With the aid of advisers, the individual basic science elective program is devised to include an area of scholarly work to pursue which may or may not be an independent biomedical research project. Any combination of: (a) research preceptorship, (b) tutorials, or (c) courses inside or outside the home base study program may comprise the overall basic science elective experience. With rare exception, the basic science elective experience should be taken as a block. During the eight months that comprise the third year, students are required to complete thirty-two basic science credits.

Fourth Year. The clinical elective experience, usually occurring in the fourth year, should be used to: (a) aid in decision making about the area of choice of postgraduate training, (b) obtain experiences in areas that would not be included in that postgraduate training, and, above all, (c) pursue active experiences in patient care sufficient to provide the basic skills necessary for doctor-patient interaction. To satisfy requirements for the M.D. degree, students must complete thirty-two clinical science credits during the fourth year.

Effective for Students Completing Third Year Requirements Prior to the 1993-94 Academic Year.

Third Year. The standard curriculum for third year students requires that eight months of a combination of basic science research and courses be completed for a total of thirty-six basic science credits. A small number of students, however, receive approval to complete twelve months of intensive basic science research. Such students earn forty, rather than thirty-six, basic science credits during the third year. Students participating in approved M.D./Ph.D. programs at Duke and most students entering with doctoral degrees in basic sciences are granted forty basic science transfer credits toward the fulfillment of degree requirements.

Clinical Credits During the Basic Science Elective Year. During the third year, students in the standard eight month program may register for a maximum of four clinical credits while completing the basic science curriculum. Special students in the twelve month basic science program may not register for any clinical credits, including as audits, during the fall, spring, and summer terms that comprise the third year. Students who are on leave from the Medical School to seek doctoral degrees in basic sciences through the Duke Graduate School may concurrently register for a total of four clinical credits in the School of Medicine with the written permission of the following individuals: the director of the Medical Scientist Training Program, the Graduate School program advisor, the Medical School advisory dean. Individuals earning degrees (a) away from Duke, (b) in non-basic science departments through the Duke Graduate School, or (c) at Duke professional schools are prohibited from enrolling in clinical courses at the Medical School while on leaves to pursue the alternate degrees.

Fourth Year. Students participating in the standard, basic science program are required to complete thirty-six clinical science credits during the elective years. Students who are permitted to count forty basic science credits toward graduation requirements as specified above are required to complete thirty-two clinical science credits. All students must complete a total of seventy-two elective credits to be eligible for graduation.

Promotion. Where appropriate, certification by the individual faculty person or by the delegated representative of each departmental chairman that a student has satisfactorily completed requirements for a course shall constitute grounds for a grade of *Pass(P)* or *Pass with Honors (H)*. *Pass with Honors* is reserved for those students who have performed in an exemplary manner in the opinion of the faculty. A grade of *Satisfactory (S)* or *Unsatisfactory (U)* is used to rate performance in a course for which the award of the grade of *H* is prohibited.

An *Incomplete (I)* grade is reserved for those students who have not met all of the requirements because of illness or other such extenuating circumstances, or because of the inability to attain sufficient understanding of course material without additional study. *Incompletes* that are not satisfied within one calendar year (unless an extension is granted by an advisory dean and the registrar) automatically become grades of *Fail(F)*. It is the departmental chairman's responsibility or that of the delegated representative of the departmental chairman to certify that an *Incomplete* has been satisfied and to so notify the registrar. A *Pass* grade is placed alongside an *Incomplete* on the permanent and official transcript. All first year courses must be satisfactorily completed before a student may enroll in second year courses. Normally, all second year courses must be satisfactorily completed before a student may enroll in the elective curriculum.

A *Fail* grade is recorded on the permanent record of a student by the registrar upon certification by the individual faculty person or the delegated representative of the departmental chairman that unsatisfactory work has been done in the opinion of the faculty. Failures cannot be erased from the permanent record but the requirements of the course may be satisfied by repeating the course in a satisfactory manner at which time a passing grade is recorded on the official and permanent transcript.

Each student's record is reviewed periodically by promotions committees composed of course directors or their designees from the appropriate departments. Recommendations by these committees are made to the dean of medical education who may follow one of several options:

1. Promote students whose work is satisfactory;
2. Warn students whose work is less than satisfactory that they must improve their scholastic endeavor;
3. Place on probation students whose work is unsatisfactory; or
4. Request the resignation of any student who is considered an unpromising candidate for the degree of Doctor of Medicine.

A student wishing to appeal a decision may do so to the dean of medical education within two weeks of notification.

The dean of medical education, with the advice of the Medical Center Policy Advisory Committee, reserves the right to require the withdrawal of any student at any time if, in his opinion, the student should not continue in the School of Medicine.

Satisfactory Progress. Satisfactory progress for students in the School of Medicine is construed as the successful completion of all requirements necessary for the advancement from one year to the next. These requirements are as follows:

First to Second Year. Completion of core basic science courses in one calendar year.

Second to Third Year. Completion of core clinical science courses within fourteen months.

Third to Fourth Year. Completion of 32 basic science credits within nine months.

Fourth Year to Graduation. Completion of 32 clinical science credits within one calendar year.

Standards for advancement for students completing third year requirements prior to the 1993-94 academic year are the same as above for advancement from the first to the second year and from the second to the third year. Third year and fourth year requirements are as follows:

Third to Fourth Year. Completion of 36 elective credits within one calendar year.

Fourth Year to Graduation. Completion of an additional 36 elective credits within one calendar year.

In unusual circumstances (including illness, remediation or irregular sequence of courses) the determination of satisfactory progress (for both academic and financial aid purposes) is made by the dean for medical education.

Course Load. The maximum registration for any term is eighteen credits with no more than five credits in any four week period during the elective years. For students completing third year requirements prior to Fall of 1993, the maximum registration is twenty credits. Enrollment for credit above these limits must have the written approval of the advisory dean.

Audit and No Credit Courses. With the consent of the appropriate instructor, *fourth* year students are permitted to audit one course a semester in addition to the normal program. Students who audit a course do not actively participate, submit work, or receive credit for the course. Because of the nature of an audited course, most clinical science courses cannot be audited. However, those offered in a lecture format (as indicated in the Elective Book provided to third and fourth year students) may be audited with the written permission of the instructor. An audited course may not be repeated for credit.

Third year students may register on a "no-credit" basis only for clinical courses whose total, combined weight does not exceed four. Such courses are not considered to be "audits". Students are expected to participate fully in these courses and are graded upon the quality of their work.

Leave of Absence. A student, after presenting a written request to the dean of medical education, may be granted an official leave of absence for personal or academic reasons for two or more consecutive terms but not to exceed one calendar year. If approved, the dean provides written notification including applicable beginning and ending dates to the student, the registrar, and the director of financial aid. The student must apprise the dean in writing of her or his wish to return to the Medical School or to extend the personal leave at least sixty calendar days prior to the anticipated date of re-entry. The student desiring an extension beyond one calendar year may be required to apply for readmission to the School of Medicine. When a leave of absence is taken during the first or third year, the dean may require the student to repeat some or all of that year's academic program. To be eligible for a voluntary leave of absence, a student must have met all financial obligations to the university.

Permission to take a leave of absence for medical reasons must also be sought in writing and is usually granted for thirty days. If additional medical leave time is desired, the student's physician is requested to submit documentation concerning the need for a continuation of the leave. A medical leave extending beyond ninety days requires a statement from the student's physician attesting to her or his fitness to return to the Medical School as a full-time student.

To be in compliance with federal regulations, the maximum time periods for leaves of absence may be altered for those students receiving federal financial aid funds. In all cases of leave of absence, the student is required to complete the full curriculum to be eligible to earn the M.D. degree.

Commencement. Graduation exercises are held once a year, in May, when degrees are conferred on, and diplomas are issued to, those who have completed requirements by the end of the spring semester. Those who complete degree requirements at the end of the fall or summer terms receive diplomas dated 30 December or 1 September, respectively. There is a delay of about one month in the mailing of September and December diplomas because diplomas cannot be issued until they are approved by the Academic Council and the Board of Trustees.

Interinstitutional Program. Under an agreement with Bowman Gray Medical School, East Carolina University School of Medicine, and the University of North Carolina-Chapel Hill School of Medicine, Duke Medical School allows students participating in the elective

program to take courses at participating institutions for grades and credit toward the M.D. degree at Duke. Courses taken are usually not available at the home institution or are not offered at times that can be accommodated by the student's schedule. Students enrolled in interinstitutional courses are charged the current Duke tuition and student health fees.

Medical Licensure. The licensing process in the United States is in transition. Students who graduate from medical school by December, 1993 are eligible to take the NBME (National Board of Medical Examiners) exams or FLEX (Federal Licensing Examination) tests for licensure. Students who enter medical school in 1990 and after, and anyone entering medical school before 1990, but who will graduate after December, 1993, must pass three tests of the new United States Medical License Examination (USMLE). Step 1 (basic science) and Step 2 (fundamental clinical science) must be passed, in no particular order, to be eligible to take Step 3 (advanced clinical science). Duke Medical School considers licensure to be the responsibility of the individual. The curriculum is not directed to prepare students specifically for licensure examinations; however, satisfactory performance in medical school should provide sufficient information and experience to pass Step 1 and 2 tests. Since Duke regards licensing as an individual's responsibility, passing these examinations is not a requirement to progress through the curriculum. Step 1 is offered in June and September, Step 2 in March and September, and Step 3 in June and December.

Visiting Students. The School of Medicine provides opportunities for visiting students to enroll in elective courses for a maximum period of eight weeks. The School of Medicine does not offer long term or extensive clinical experience (sometimes called externships or clerkships) sufficient to satisfy the clinical educational requirements of foreign medical schools. Payment of a registration fee (currently \$50.00, subject to change) and a student health fee are required. For information write to: Coordinator, Visiting Students, Box 3005, Duke University Medical Center, Durham, North Carolina 27710.

Education Records. In accordance with the Family Education Rights and Privacy Act of 1974 (FERPA), Duke University permits each student to inspect her or his education records and limits disclosure to others of personally identifiable information without the student's prior consent.

Education records include those records which contain information directly related to a student and are maintained as official working files by the university. They do not include records made by faculty and administrators for their own use and not shown to others; campus police records; employment records; records of physicians, psychologists, etc., made or used only for treatment purposes; and records containing information relating to a person's activities after she or he graduates or withdraws from the university. Information within a student's education file pertaining to the parents' financial records are restricted from the view of the student.

Certain categories of information are considered to be directory information and, as such, do not require the student's prior written consent to be disclosed. However, upon written notice, the Medical School Registrar's Office is happy to comply with a student's request to withhold such information. The following have been designated as directory information by the university: name, address, telephone listing, date and place of birth, photograph, major field of study, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance, degrees and awards received, and most recent previous educational institution attended.

In addition, prior consent is not required for disclosure of education records to school officials of Duke University who have been determined to have legitimate educational interests, appropriate parties in connection with an emergency, and in response to a court order or subpoena.

Following appropriate procedures, the student may challenge the content of the education record. Also, copies of these records can be obtained by paying reproduction costs of fifteen cents per page. Information on additional exceptions or the complete policy and

procedures of Duke University in regard to FERPA is available upon request at the Office of the Medical School Registrar.

Combined Degree Programs

Medical Scientist Training Program. The Medical Scientist Training Program is designed for highly qualified students strongly motivated toward a career in medical sciences and academic medicine. It provides an opportunity to integrate graduate education in one of the sciences basic to medicine with the full clinical curriculum of the School of Medicine. The program requires, on the average, six to seven years of study and leads to both the M.D. and Ph.D. degrees. Although the special emphasis of this program is on basic medical science, the trainees, because of their education in clinical medicine, have a remarkable range of career opportunities open to them. Graduates of this program follow one of two broad paths. Some embark directly on careers in teaching and research in one of the basic medical sciences, while maintaining strong ties with clinical science as a result of their combined training. Others enter residency programs before pursuing investigative and teaching careers in clinical medicine, carrying with them strong academic backgrounds which allow them to conduct fundamental research with a foundation of superior training and experience in basic sciences.

Eligibility. Applicants must meet the admission requirements of both the Medical School as a candidate for the M.D. degree, and the Graduate School as a candidate for the Ph.D. degree. Most candidates apply for admission to the first year of the program, but in special cases applications can be accepted from students who are in residence in the Medical School or Graduate School of Duke University. In addition to the minimum requirements for acceptance to the Medical School and the Graduate School, advanced course work in science and mathematics and prior research experience (or other evidence of research aptitude) counts heavily in the selection of candidates.

Financial Support. Students admitted to the first year of the program receive a traineeship award, consisting of a stipend and full tuition allowance, provided by a National Research Service Award from the National Institutes of Health. Currently the annual stipend is \$11,000, and financial support from that award can be furnished for up to six years, assuming normal progress. These six years need not be consecutive; this permits flexibility in funding in case more than six years are required for completion of the curriculum. Funding by the NIH is limited to citizens or permanent residents of the United States.

The Training Program. This program is designed to offer trainees great latitude in the selection of course material. Basic requirements are two academic years composed of the first basic science year and the second clinical science year of the curriculum for medical students at Duke University. Following completion of the second year, the trainee enters the graduate program to complete the requirements for the Ph.D. degree. One more academic year of elective clinical study is necessary to complete the requirements for the M.D. degree. Both degrees are awarded at the completion of this sequence. Minor variations in this schedule can be arranged if this is advantageous to the student's education.

Year 1—Core Basic Science Year. This year consists of courses in anatomy, biochemistry, cell biology, genetics, human behavior, immunology, microbiology, neurobiology, pathology, pharmacology, and physiology.

Year 2—Core Clinical Science Year. This year encompasses a comprehensive approach to medicine oriented to the patient as a whole. The year provides fundamental training in clinical medicine, with emphasis on the relationships between general biological processes, from conception through birth, development, and maturation to senescence and death, as well as individual clinical states. Special consideration is devoted to the pattern of developmental sequences and to the changes in that pattern determined by genetic composition and the particular environment in which the patient lives.

During the second year, the trainee is taught primarily by teacher-investigators from the clinical departments. The Introduction to Clinical Diagnosis course occupies the seven weeks preceding the core clinical rotations. The balance of the second year consists of eight-week

rotations in internal medicine, surgery, obstetrics/gynecology, pediatrics, psychiatry, and either an eight-week rotation in family medicine or a four-week rotation in family medicine and a four-week rotation in neurology.

Years 3, 4, 5, (6)—The Graduate Years. During the third, fourth, fifth and, if necessary, sixth year of the program, the trainee pursues graduate study to satisfy the requirements for the Ph.D. degree.

These requirements include: (1) completion of necessary course work, (2) adequate performance in the preliminary examination, (3) original research suitable for a dissertation, and (4) successful defense of the thesis in the final examination. Detailed description of the other general requirements for the Ph.D. degree are stated in the *Bulletin of the Graduate School*.

The graduate curriculum of each trainee is developed in consultation with the director of graduate studies of the department in which the trainee elects to study and requires the approval of the Medical Scientist Training Program Committee. Since most of the ordering ideas and experimental techniques of all the medical sciences derive from mathematics and the physical sciences, it is essential to ensure that all students in the program have an adequate foundation in these subjects. Because of the close working relationship and geographical proximity of the departments of medical and physical sciences at Duke, the setting is unusually favorable for the achievement of that goal.

Descriptions of the graduate courses in the Departments of Biochemistry, Cell Biology, Microbiology, Immunology, Neurobiology, Pathology, Pharmacology, Biomedical Engineering, Chemistry, Zoology, the Sections of Cell Growth Regulation and Oncogenesis and Genetics are listed in the *Bulletin of the Graduate School*. Trainees are encouraged to select courses which relate to their developing individual interests rather than follow a prescribed curriculum applied to all students in a given discipline. Such range, flexibility, and freedom are the essence of graduate education. The original research and dissertation of each trainee is supervised by a faculty adviser chosen by the trainee in consultation with the director of graduate studies in the appropriate department. The faculty adviser is the chairman of the trainee's supervisory committee, which consists of at least three members from the major department. This committee generally administers the preliminary examination before the student commences original research and the final examination after the student completes the dissertation.

Final Year—An Elective Year in Clinical Science. In this year, which is entered only after completion of all requirements for the Ph.D. degree, a faculty adviser from the clinical discipline in which the student is most interested is assigned. The student and the adviser construct an individualized curriculum, which often places major emphasis on one clinical area and minor emphasis on other fields. One aim is the integration of research interests and clinical experience in such a way that the student's research competence is facilitated; therefore, this year is planned with regard to the trainee's proposed career in research as well. This elective year provides further training in clinical medicine to complement the second or core clinical year, so that the trainee's total clinical experience is the same as that given in the regular clinical years of medical school (the third and fourth years in the majority of schools). It should be noted that since students in the program receive the M.D. degree upon completion of this final year, great care is taken by the faculty to ensure that students are competent and knowledgeable in current concepts of patient care. It is hoped that the final year provides the student with an experience which is not repeated during the residency but serves to complement later phases of training. Thus, future surgeons might be exposed to fields other than surgery, since they receive intensive training in that discipline during their residency programs.

Application and Admission Procedure. The following guidelines should be observed by individuals applying to the Medical Scientist Training Program.

1. The application form for the Duke University School of Medicine should be completed and submitted as early as possible, since acceptance into the Medical Scientist Training Program requires acceptance by both the Program Committee and the

Medical School Admissions Committee. Applicants who cannot be accepted into the program are still fully eligible for acceptance to the Medical School if the Medical School Admissions Committee considers them qualified and desirable.

2. The application form for the Medical Scientist Training Program should be completed and submitted no later than 1 December. The application to the School of Medicine should be mailed no later than 15 December.
3. To facilitate review of this application, the Medical College Admission Test should be taken, if possible, in May of the year in which the application is submitted.
4. Only those applicants who are accepted for the program are requested to complete an application form for the Graduate School. The Graduate Record Examination is not required for this purpose.
5. Applicants are notified about acceptance into the program on or about 15 February.

Additional information may be obtained by writing Salvatore V. Pizzo, M.D., Ph.D., Director, Medical Scientist Training Program, Box 3712, Duke University Medical Center, Durham, North Carolina 27710.

The Medical Historian Program. The Medical Historian Program is conducted under the auspices of the School of Medicine and the Graduate School. Two courses are offered: a combined M.D.-Ph.D. (extending over six years) and a M.D.-M.A. (four or five years depending on use of summer sessions). The choice of Ph.D. or M.A. depends on the career goals of the students. Those wishing to put a major effort into scholarly activities in the history of medicine will generally be advised to undertake the Ph.D.

The basic requirements for both courses are two academic years in the School of Medicine consisting of core basic sciences in the first year and core clinical rotations in the second year. The student then enters the Department of History. A range of appropriate courses are available. Following the completion of the Ph.D. or M.A., the student resumes requirements for the M.D. degree.

Application and Admissions Procedures. Applicants must meet the requirements for admission to the School of Medicine and the Graduate School in the Department of History. Candidates who have completed two years of medical school are also considered. In addition to the minimum requirements established by the School of Medicine and the Graduate School, courses in history and in the history and philosophy of science count in the selection of candidates.

Applicants should complete and submit an application form to the Duke University School of Medicine and to the Graduate School for admission to the Department of History.

Additional information may be obtained by writing to: Peter C. English, M.D., Ph.D., Box 3675, Duke University Medical Center, Durham, North Carolina 27710.

The Medicine and Public Policy Program. This program, which normally requires a maximum of five years to complete, is offered to meet the growing demand for persons who combine medical skills and training with a capacity for analytic public decision-making. It aims at training those persons with requisite talent to be leaders in the development and implementation of health policy at all levels of government. Such leadership might be provided as an elected or career public official, as a leader of medical professional organizations, or as a practicing physician or medical scholar active in public affairs.

Utilizing the faculty and resources of the School of Medicine and the Terry Sanford Institute of Public Policy, the program offers students a multidisciplinary education that aims at providing:

1. A complete course of study in basic medical sciences and clinical training in the practice of medicine identical in scope and rigor with the education received by students enrolled in the Doctor of Medicine program alone;
2. Familiarity with the organization and financing of health services, with particular focus on the economics and politics of health care;

3. An understanding of the political, bureaucratic and social processes that define public problems and limit alternative approaches to their solutions;
4. A capacity for quantitative and logical methods of analysis useful in forecasting and appraising policy consequences and in evaluating existing policies;
5. An understanding of the uses and limitations of various analytic techniques and an awareness of the value considerations and ethical choices implicit in particular policy alternatives.

During the first two years at Duke, students enroll in the normal course of study in the School of Medicine. In the third year, course work shifts primarily to the institute. In the fourth year, students do most of their work in the School of Medicine and complete a client-oriented study of a particular problem in health policy. During the fifth year, students complete their requirements in the School of Medicine, at the completion of which they receive both the M.D. and Master of Public Policy (M. P. P.) degrees.

Admissions. Students may apply for admission to the program in medicine and public policy concurrent with application to the School of Medicine or during their first or second years.

Applications. Requests for applications and specific questions about the program should be addressed to the Director of Graduate Studies, Terry Sanford Institute of Public Policy, P.O. Box 90243, Durham, North Carolina 27708-0243.

The M.D.-J.D. Program. The School of Medicine and the School of Law of Duke University jointly sponsor a highly selective program of combined medical and legal education. The program provides an opportunity to acquire a full basic study of the two fields. Upon satisfactory completion of the required course of study, candidates will be awarded both the M.D. and the J.D. degrees.

Course of Study. The student in the M.D.-J.D. Program generally begins a six-year course of study in the School of Medicine. As in the regular M.D. Program, the first year is devoted to the basic medical sciences and the second year to the basic clinical disciplines. At this point the student enters the School of Law, where the first-year curriculum is the same as that of other law students. During the next two years the student takes approximately one and one-half years in the law curriculum, including available health law courses, and one-half year of elective basic science work. In addition, some students pursue legal clerkships during these two summers to gain experience in health care law. The sixth and final year is spent in elective clinical work in the medical school tailored to the student's specialized needs.

Eligibility. Applicants for the M.D.-J.D. Program must qualify for admission to both the School of Medicine and the School of Law. The usual approach is to apply for both schools simultaneously, thus reserving a place in the program prior to arrival. Applications are also accepted from members of the first and second year medical school class for admission to the School of Law and from the second year law school class for admission to the School of Medicine. Neither school gives preference to joint degree candidates in the admissions process.

Application Procedure. Application forms for the School of Law may be obtained by writing to the Office of Admissions, Duke University School of Law, Durham, North Carolina 27706. Applications for the School of Medicine shall be made by utilizing the AMCAS procedure described in this bulletin.

Deadlines. For those seeking simultaneous admission to both schools: at the end of the junior year take the new Medical College Admissions Test (MCAT) and the Law School Aptitude Test (LSAT).

For the Medical School, complete the AMCAS application procedures. Upon receipt of the supplemental application form from Duke, check the box indicating M.D.-J.D. Program. Deadline for AMCAS procedure is 1 November. There is no deadline for the Law School but 15 January or earlier submission is suggested.

The M.D.-M.P.H. Program. Students enrolled in the School of Medicine, after satisfactory completion of the first two years of the regular curriculum, may request approval to seek a Master of Public Health degree at the University of North Carolina, Chapel Hill, or at another approved institution. The program is designed to train physicians in epidemiology, biostatistics, environmental and occupational health, and in planning, administering, and evaluating health care delivery systems. Upon receipt of the M.P.H. degree, students are awarded 18 basic science credits toward the M.D. degree.

For additional information contact the M.D.-M.P.H. Advisor, W. Eugene Broadhead, M.D., Ph.D., Department of Community and Family Medicine, Duke University School of Medicine, Box 2914, Durham, NC 27710 or call 919/286-8253. Interested students must obtain written approval to pursue the M.D.-M.P.H. program at the beginning of the second year.

Graduate Medical Education

Residencies. Appointments are from 1 July through 30 June with few exceptions. Residents receive stipends, professional liability insurance, disability insurance, life insurance, uniforms, and laundry of uniforms.

Residencies offered with the chairman or chief of each service are as follows:

Anesthesiology (Chm.)	J. G. Reves, M.D.
Family Medicine (Chm.)	George Parkerson, M.D.
Occupational Medicine (Chf.)	George Jackson, M.D.
Internal Medicine (Chm.)	Joseph Greenfield, M.D.
Dermatology (Chf.)	Sheldon Pinnell, M.D.
Neurology (Chf.)	Allen Roses, M.D.
Obstetrics and Gynecology (Chm.)	Charles Hammond, M.D.
Ophthalmology (Chm.)	David Epstein, M.D.
Anatomic and Clinical Pathology (Chm.)	Salvatore Pizzo, M.D., Ph.D.
Dermatopathology (Chf.)	Robin Vollmer, M.D.
Neuropathology (Chf.)	Peter Burger, M.D.
Pediatrics (Chm.)	Michael Frank, M.D.
Pediatric Allergy (Chf.)	Rebecca Buckley, M.D.
Pediatric Cardiology (Chf.)	Brenda Armstrong, M.D.
Psychiatry (Chm.)	Allen Frances, M.D.
Child Psychiatry (Chf.)	Charles R. Keith, M.D.
Radiology (Chm.)	Carl Ravin, M.D.
Diagnostic Radiology (PTD.)	Reed Rice, M.D.
Therapeutic Radiology (Chm.)	Leonard Prosnitz, M.D.
General Surgery (Chm.)	David C. Sabiston, Jr., M.D.
Neurosurgery (Chf.)	Robert H. Wilkins, M.D.
Oral Surgery (Chf.)	Donald J. Serafin, M.D.
Orthopaedic Surgery (Chf.)	James R. Urbaniak, M.D.
Otolaryngology (Chf.)	William R. Hudson, M.D.
Plastic Surgery (Chf.)	Donald J. Serafin, M.D.
Thoracic Surgery (Chf.)	David C. Sabiston, Jr., M.D.
Urologic Surgery (Chf.)	David F. Paulson, M.D.

Duke University Medical Center is a participating member of the National Resident Matching Program, One American Plaza, Suite 807, Evanston, Illinois 60201, and all applicants for first-year postmedical school appointments must register with this program.

Both men and women graduates of any L.C.M.E.-accredited medical school are eligible for appointment and all applicants are considered without regard to race, color, religion, national origin, handicap, veteran status, sexual orientation or preference, sex or age (except where sex and age are a bona fide occupational qualification).

Requests for application forms and information about straight residencies should be addressed to the chairman of the service under which training is desired. A transcript of the medical school record is required, and must either accompany the application or be furnished by the dean of the Medical School.

Graduates of medical schools outside the United States and Canada must hold a valid standard or interim certificate of the Educational Commission for Foreign Medical Graduates (ECFMG), 3624 Market Street, Philadelphia, Pennsylvania 19104, to be considered for appointment to residencies. Physicians who are not U.S. citizens or permanent residents and who need sponsorship as J-1 exchange visitors must have passed the National Board of Medical Examiners Exam (NBME) Parts I and II, or the Foreign Medical Graduate Examination in the Medical Sciences (FMGEMS) or the Visa Qualifying Examination (VQE) to be eligible for a visa. Applications should be sent directly to a department or division. An application which does not include a copy of a valid ECFMG certificate and evidence of passage of one of these exams are considered incomplete and may be discarded without further notice to the applicant. Competition for first-year positions is intense and these positions are rarely available for foreign medical graduates. For further information contact Catheryn Cotten, International Office, Box 3882, Duke University Medical Center, Durham, North Carolina 27710.

Reasonable requests for reduced scheduling are considered. Inquiries should be directed to the training program directors of approved residencies or to the Office of House Staff Affairs. For further information, please contact Mary C. Fendt, Administrator, House Staff Office, Box 3951, Duke University Medical Center, Durham, North Carolina 27710.

The Durham Veterans Affairs Medical Center adjoins the Duke University Campus and is operated under the supervision of the vice-president's Committee of the Duke University Medical Center. The full-time professional staff of the V.A. Medical Center are all faculty members of the School of Medicine. All training programs are integrated with corresponding programs at the Duke University Medical Center, including rotation of house officers at each hospital.

All residents and clinical fellows are required to be licensed by the State of North Carolina. This may be accomplished by (1) a residency training license that covers only training by Duke and is not convertible to a full North Carolina license or (2) a full North Carolina license that is a complete medical license obtained either by State Boards (North Carolina Boards can only be taken upon completion of internship) or National Boards and is fully reciprocal with other states for full licenses. Duke University Medical Center cannot make applications for house staff. Since house staff members must have the license before beginning duties, arrangements for the license should be made in advance. All incoming house staff must contact Bryant Paris, North Carolina State Board of Medical Examiners, Box 26808, Raleigh, North Carolina 27611-6808, for current licensure requirements.

Application forms and information for residencies or fellowships may be obtained by writing the chairman of the appropriate department, Duke University Medical Center, Durham, North Carolina 27710.

Auditing of Courses by House Staff. Residents and fellows at the Medical Center may audit courses through the undergraduate and graduate divisions of Duke University by obtaining the written permission of the course instructor and the dean for continuing education and by paying the current audit fees. House staff members are not permitted to take courses offered through the division of undergraduate medical education. For more information, please contact Dr. Judith Ruderman, Academic Dean for Continuing Education, The Bishop's House, Duke University, Durham, North Carolina 27708, (919) 684-6259.

Postgraduate Education

Continuing Medical Education. From its beginning in 1930, Duke has been committed to and actively engaged in a program of training young men and women for academic and scientific careers, as well as for the practice of medicine. This philosophy in concert with the aims and goals of both the School of Medicine and Duke University Hospital has fostered the development of continuing medical education, the mechanism for providing opportunities to continue the pursuit of excellence in medical education.

Mission. The Duke University Medical Center with its School of Medicine and Hospital are committed to the continuing education of physicians and other health professionals. A goal of improving patient care provides the impetus of programs for continuation of physician education following undergraduate and graduate medical education. The medical administrators of the Medical Center recognize that there is an educational responsibility which is included in the medical mission of the institution.

Within the purview of the Duke University School of Medicine and the academic affairs branch of the Medical Center, the Office of Continuing Education (CME) has been designated to implement the institution's commitment to continuing medical education.

The dean of medical education appoints the associate dean of continuing medical education who is responsible for providing leadership, liaison, and recommendation for departmental and institutional CME activities.

To assist the associate dean of continuing medical education, the dean has appointed a committee that assists with the implementation of continuing medical education. The committee is composed of representatives from the departments, special divisions, or special areas of the Medical Center. The committee is charged with advising on policies and procedures for the development of continuing medical education within the School of Medicine and the Medical Center.

The Office of Continuing Medical Education and the committee are jointly charged with the following responsibilities:

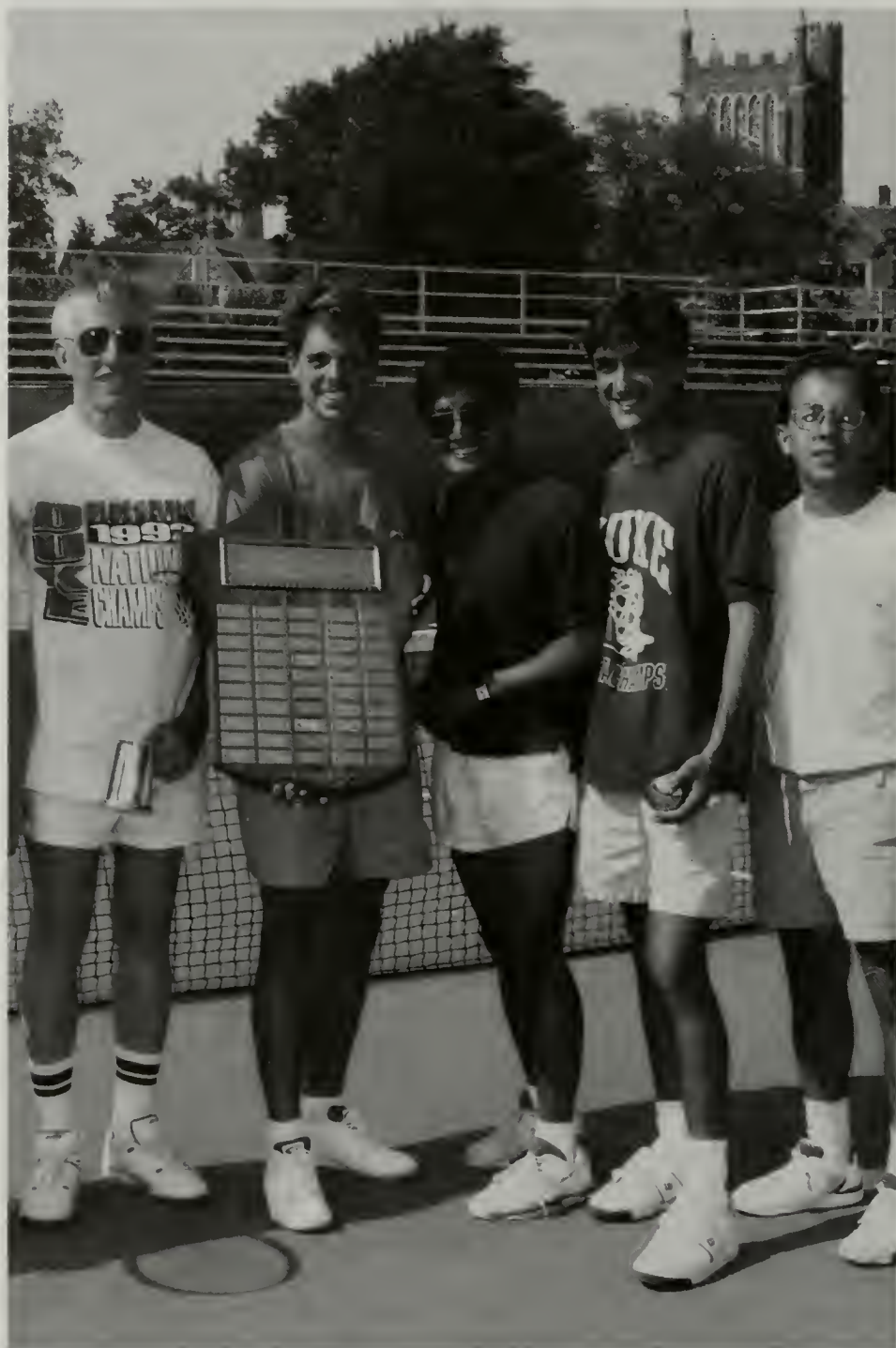
1. Advise on development of CME policies and procedures;
2. Initiate CME activities;
3. Maintain the CME program's national accreditation;
4. Offer CME credit for approved activities;
5. Monitor CME activity development and execution in response to the needs of practicing physicians;
6. Maintain responsibility of recording CME credits issued to participants of all Duke University School of Medicine approved activities;
7. Provide guidelines, recommendations, and support for new and innovative CME activities following appropriate needs assessment;
8. Initiate CME activities in cooperation with departments of the Duke University Medical Center, the Office of Medical Alumni Affairs, and other appropriate organizations within the institution that embrace the CME commitment to alumni and practicing clinicians in the state, region, and nation; and,
9. Seek new sources of additional support for CME programming and development.

Numerous formal postgraduate courses are given throughout the entire year for physicians in general practice as well as in all specialties. Conferences and tutorial seminars are also available to any physician who desires to attend and participate. Physicians in practice may make arrangements for a period of one day or more for courses tailored to their particular interests. These personal contacts with senior faculty and residents, including patient examinations as well as follow-up care, provide in-house training experience.

For additional information, please contact Cynthia C. Easterling, M.Ed., Director, Continuing Medical Education, Duke University Medical Center, Box 3108, Durham, North Carolina 27710, (919) 684-6878 or toll free 1-800-222-9984.



Student Life



The University

Duke University, located in Durham, North Carolina, has an enrollment of 10,826 students from all fifty states and from many foreign countries. Currently, Trinity College of Arts and Sciences, the Graduate School, and the Schools of Business Administration, Divinity, Engineering, Environment, Law, Medicine, and Nursing comprise the university.

Durham, with a population of 136, 611, is in the Piedmont region of North Carolina and has easy access to the sea coast and mountains. It is one of the three cities bounding the Research Triangle Park where numerous private research laboratories and governmental agencies are located. Duke University is twenty-five miles from North Carolina State University in Raleigh, eight miles from the University of North Carolina at Chapel Hill, and is in the same city as North Carolina Central University.

Conduct of Students

Duke University expects and requires of all its students cooperation in developing and maintaining high standards of scholarship and conduct.

All students are subject to the rules and regulations of the university which are currently in effect or which, from time to time, are put into effect by the appropriate authorities of the university.

Any student, in accepting admission, indicates the willingness to subscribe to and be governed by these rules and regulations and acknowledges the right of the university to take such disciplinary action, including suspension and/or expulsion, as may be deemed appropriate for failure to abide by such rules and regulations or for conduct adjudged unsatisfactory or detrimental to the university.

Living Accommodations

Duke University has two residential apartment facilities in which graduate and professional students live. These apartments are available for continuous occupancy throughout the calendar year. All the apartments are completely furnished by the university. An itemization of furnishings is included with the floor plans sent out in the application packet.

Spaces in apartments for single students are provided on an individual basis with each student paying rent per academic term to the university. This method permits students to

share apartments with others of their choice. When this is impractical, the Department of Housing Management strives to place persons with similar interests together.

Town House Apartments. Town House Apartments, located about three blocks from the main East-West Campus bus line, is a thirty-two-unit complex. These apartments are more spacious than most apartments found on campus or in Durham. Because of its location away from the academic facilities, students find that these apartments offer a change from normal campus life and activities.

Each air-conditioned apartment includes a living room, a master bedroom, a smaller bedroom, a bath and a half, and an all-electric kitchen with a dining area. Spacious closets and storage spaces are provided within each apartment. A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months.

Occupants must make arrangements with the local telephone company, GTE, to pay for telephone service. GTE usually requires a deposit when initial application for service is made. The company should be contacted prior to arrival as it usually takes several days to obtain service.

Central Campus Apartments. During 1975, Duke University completed a 500-unit apartment complex.

A swimming pool, located in the center of the complex, is open during the late spring and throughout the summer months. Additional facilities include a pub, convenience store, tennis courts and basketball courts.

All utilities—water, heat, air-conditioning, and electricity—are provided. Telephone jacks are provided in each apartment. Duke University's Tel-Com supplies telephone service. Central Campus Apartments residents are responsible for providing their own phones and having them connected.

Efficiency, two-bedroom, and three-bedroom apartments are rented to graduate students. Efficiency units are very limited in number and are not generally available to new students.

Application Procedures. When students are informed of their acceptance to the Medical School they will also receive a postcard on which to indicate preference for university housing. This postcard should be returned to the Department of Housing Management. Detailed information on the types of accommodations and application forms will be forwarded to the accepted student. Assignment to all university housing is made on a first-apply, first-assigned basis, and it is not guaranteed.

Off-campus Housing. The Department of Housing Management maintains a listing of rental apartments, rooms and houses provided by property owners or real estate agencies in Durham. These listings are available in the department only; during the summer an assistant is available to answer questions and aid students in their attempt to obtain housing off campus. Information on commercial complexes in the Durham area may be obtained by indicating a preference for off-campus housing on the postcard which you will receive with your acceptance notice. Except for assuring that owners sign a statement of nondiscrimination, off-campus property is in no way verified and neither the university nor its agents negotiate between owners and interested parties.

The search for accommodations should begin as soon as possible after acceptance to the Medical School. A visit of two or three days will allow you the opportunity to make use of the off-campus service and to inspect personally the availabilities.

Dining Facilities. In addition to the Medical Center cafeteria, a number of dining facilities are located within a short distance from the Medical Center. Duke Dining Services operates a variety of dining facilities, including an all-you-can-eat cafeteria, several a la carte restaurants, and fast food facilities. The many dining locations on campus give Duke students virtually unlimited dining options. For more information about campus dining options,

contact Dining Services at 029 West Union Building, Box 90898, Durham, NC 27708-0898, 919/660-3900.

Services Available

Student Personal and Professional Advisory Program. One important objective of Duke University School of Medicine is to promote an informal, cordial student-faculty relationship. It is also felt that this type of relationship will promote better curriculum advising and career advising for the student. Each entering student is assigned to one of four advisory deans, who oversees his/her academic progress and with whom the student will meet in small groups and individually for personal advising, curriculum planning, and career counseling. A full-time associate dean is available to students for personal and crisis counseling or referral on a strictly confidential basis.

Student Health Program. The Student Health Program is administered by the Department of Community and Family Medicine, Duke University Medical Center. Medical services are provided by board-certified family physician faculty and by physician assistants, nurse practitioners, and resident physicians under faculty supervision.

Duke Family Medicine Center. The DFMC (684-6721), located on the corner of Erwin Road and Trent Drive in the Marshall Pickens building, is the primary location for medical care. Students are seen by appointment Monday-Friday, 7:00 a.m.- 7:30 p.m., Saturdays from 9:00 a.m.-12:30 p.m., and Sundays from 2:00 p.m.- 4:30 p.m. A wide variety of services are available: general medical care, health education, sports medicine, laboratory, pharmacy, travel and immunization, x-rays, cold/flu self-help table, allergy clinic, and nutrition counseling.

Students are encouraged to use the Duke Family Medicine Center as their portal of entry to other health resources when needed, including the specialty clinics at Duke University Medical Center. This will help with coordination of appropriate care.

For problems arising after hours, students should call the Infirmary (684-3367). After consulting with the physician on call, the nurse may advise the student to come to the Infirmary or to the Duke Emergency Department (684-2413) for further evaluation. In the event of an obvious life-threatening emergency, students should go directly to the Emergency Department. If necessary, Duke Public Safety (call 911 or 684-2444) will provide on-campus transportation to the Emergency Department or the Infirmary.

The Infirmary. The Infirmary (684-3367), located on the fourth floor of Duke University Hospital South Division, purple zone, provides inpatient treatment of illnesses too severe to manage in the residence hall or apartment, but not requiring hospitalization.

Health Education. This component of the Student Health Program is headquartered at Trent Drive Hall, and at the Healthy Devil Health Education Center in House 0 on West Campus. Health education staff are available to assist students in making informed decisions that promote their health. Topics of concern include alcohol and other drug usage, eating and nutrition, sexual activity and sexually transmitted diseases, stress management, and others.

Sports Medicine Services. The Student Sports Physical Therapy Clinic is located on West Campus, in the basement of Card Gym. A physical therapist is available from 3:00-6:00 p.m. weekdays, on a walk-in basis, to assess exercise-related problems, and to outline short-term treatment plans to aid recovery, and help prevent re-injury. The Sports Medicine Clinic is located on the third floor of the Finch-Yeager Building adjacent to Wallace Wade Stadium. There students may be seen by a student health physician, by appointment (684-6721).

Confidentiality. Information regarding the physical or mental health of students is confidential, released only with the student's permission.

Health Fee. All currently enrolled full-time students and part-time degree candidates are assessed a mandatory student health fee. This covers most services rendered within the Student Health Program (see below) during each enrolled semester. An optional summer health fee for students not enrolled in summer sessions is also available through the bursar's office.

Health insurance is essential to protect against the high cost of unexpected illnesses or injuries which would require hospitalization, surgery, or the services of specialists outside the Student Health Program. All students are required to have such insurance. For those not adequately covered by other insurance, the Duke Student Insurance Plan is specifically designed to complement the coverage provided by the student health fee. Coverage for the student's spouse and dependent children may be purchased. Further information about this plan may be obtained from the student insurance office (684-6455) or from Hill, Chesson, and Associates (489-7426).

Services Covered by the Health Fee. The health fee covers most of the services at Duke Family Medicine Center if medically indicated and rendered by a student health provider:

- medical care for acute and chronic illness, and minor injuries
- one annual health maintenance examination and associated studies
- most routine laboratory and x-ray services
- confidential pregnancy testing
- most medications required for short-term treatment of acute problems
- immunizations required for programs receiving academic credit at Duke (note: a supplemental fee may be required for certain immunizations), excluding prematriculation immunizations

The health fee covers a variety of other services at DFMC and other locations:

- health education and health promotion including nutrition consultation
- sports medicine, not including specialists' (orthopaedic) services
- infirmary service, not including meals and not including diagnostic testing ordered by specialist consultants
- mental health and career counseling at CAPS

Services not Covered by the Health Fee. If you are unsure whether a service is covered, *please ask one of the student health staff prior to receiving the service.* You are financially responsible for the following:

- medical care provided in the Emergency Department, hospital, or other non-student health facility
- dental care
- pregnancy care or deliveries
- tests, procedures, prescriptions not medically indicated or those ordered by non-student health providers
- immunizations required for entrance to Duke or other universities, or for personal travel
- medications not on the student formulary and those required for long-term use; contraceptives

Upon arrival on campus, all students receive a detailed brochure about the program and the services covered by the student health fee.

Student Health Program, Howard J. Eisenson, M.D., *Director*, Pickens Building

Counseling and Psychological Services. Counseling and Psychological Services (CAPS) is located in Suite 214, Page Building on West Campus. CAPS is a component of student services which provides a comprehensive range of counseling and developmental services to assist and promote the personal growth of Duke students.

The professional staff is composed of psychologists, clinical social workers, and psychiatrists experienced in working with young adults. They provide direct services to students including evaluation and brief counseling/psychotherapy regarding a wide range of concerns. These include issues of self-esteem and identity, family relationships, academic performance, dating, intimacy, and sexual concerns. Ordinarily students are seen for counseling by appointment. If your concern requires immediate attention, a CAPS staff member will assist you with the emergency at the earliest possible time.

Each year CAPS offers a series of self-development seminars and support groups. These explore such interests as stress, relationships, awareness of diversity, and management of eating disorders. Support groups for graduate and professional school women, international students, and gay and lesbian students have been developed. Interested students may contact CAPS for further information.

Another function of CAPS is to provide consultation regarding student development and mental health issues affecting not only individual students but the campus community as a whole. The staff works with other campus personnel including administrators, faculty, the student health staff, and student groups in meeting needs identified through such liaisons.

Student and Professional Organizations

Alpha Omega Alpha. Alpha Omega Alpha Honorary Medical Fraternity was founded in 1902 and the Duke University chapter, Alpha of North Carolina, was chartered in 1931. The society works to promote scholarship and research in medical schools as well as high standards of character and comportment toward patients among students and physicians. AOA elects to its membership students who have exhibited academic promise, clinical excellence, and leadership. Membership is limited to one sixth of each graduating class, and up to half of these may be elected in the junior year. AOA membership is also conferred upon physicians, including alumni and faculty members, who have distinguished themselves in research, teaching, and practice.

Duke University Chapter Councillor: Salvatore V. Pizzo, M.D., Ph.D.

President: Michael Sicard

Vice-President: George Verghese

Davison Society. All medical students are dues-paying members of the Davison Society, named for the first dean of Duke Medical School. The society is governed by the Davison Council which consists of elected officers (president, service vice-president, social vice-president, secretary, treasurer, and intramural sports chairman) and elected representatives from each class. Primary responsibilities of the council include: chartering of medical student groups, budgeting funds for student groups and medical school activities, organization of medical school activities and social events, appointment of medical students to Medical Center and university committees, and representing student views to the pertinent faculty and administration. The Davison Council also coordinates medical student projects with community service groups such as Adopt-A-Highway, Habitat for Humanity, and Share Your Christmas.

Medical student groups affiliated with, and in the past funded by the Davison Society include: the American Medical Student Association, the North Carolina Student Rural Health Coalition, the North Carolina Medical Society Student Chapter, the Student National Medical Association, Durham City Schools Seventh Grade Sex Education Program, *Shifting Dullness* (the medical student newspaper), and the Christian Medical Society.

Meetings of the council are open to all students and minutes of council meetings are posted. The members of the council are elected in the spring of each year except for the first year class representatives who are elected during the first fall after matriculation.

The Engel Society. The Engel Society, established in 1966 as a memorial to Professor Frank L. Engel, is designed to promote intellectual and social interaction between students and faculty. Membership is limited to six junior students and six senior students who have

demonstrated an inquisitive nature, humanitarian interests, and high scholastic ability. Four faculty members are selected annually by members of the society for three year terms. Six dinner meetings with guest speakers are held each year. Other students may be invited to participate.

Duke University Medical Alumni Association. The Duke Medical Alumni Association consists of over 9,000 members including all graduates of the Medical School and all past and present house officers of Duke Hospital. A magazine is sent to all members three times annually. November reunions are held each year in Durham and regional functions are sponsored for the alumni. Several social functions for medical students are sponsored annually, as is a student seminar. The Medical Alumni Association also maintains a listing of alumni willing to host students in their local area. One of the more popular programs is the Student Candy Jar.

President: Robert "Crusty" Rosemond, M.D. '53, HS '53, Sanford, Florida; Secretary-Treasurer: Jay M. Arena, M.D. '32, Durham, North Carolina; R. C. "Bucky" Waters, Vice-Chancellor for Medical Center Development; Patricia M. Ashmore, Director, Medical Alumni Development and Programs.

Awards and Prizes

Allen Travel Award. Dr. Susan Allen (Duke alumna) has provided funds to assist a third or fourth year student in traveling to Africa for research/study of health care. Selection of an appropriate student is made by the dean; award may be up to \$1,500.

Davison Scholarship. The Davison Scholarship award, consisting of \$2,000, is supported by the Davison Club in the memory of Dean Davison to enable a medical student to participate in a clinical science elective outside the United States in an area of primary care. Any student eligible to study away may apply for the award. For consideration for the scholarship, the elective must be approved by the Study Away Committee.

Thomas Jefferson Award. This award, consisting of \$100, a certificate, and a book recognizes a graduating senior student who has made outstanding contributions to the university or to fields which have not been traditionally confined to science and medicine. The award is given by the Awards Committee to a graduating senior.

The Joseph Eldridge Markee Memorial Award in Anatomy. This award, donated by the friends and family of the late Dr. J. E. Markee, James B. Duke Professor of Anatomy and chairman of the Department of Anatomy from 1943 to 1966, consists of a certificate, medallion, and cash award of \$200. It is presented by the Department of Anatomy to the most outstanding student in anatomy during the first year in the Medical School.

C. V. Mosby Book Award. Three graduating senior students are selected by the Awards Committee for active participation in service to the students, community, and medical school. The award is a Mosby book of the student's selection.

E. Eugene Owen, M.D. Clinical Awards. Four graduating seniors are selected for a cash award based on excellence in the clinical sciences in the second and fourth years. The Owen Award honors Dr. E. Eugene Owen, a distinguished diagnostician of the Watson Clinic in Lakeland, Florida. The Watson Clinic Foundation makes these annual awards.

Trent Prize. An annual award of \$100 is given to a Duke medical student for the best essay on any topic in the history of medicine and allied sciences. Mary Trent Semans established this award in memory of the late Josiah C. Trent to encourage students to undertake independent work in the history of medicine and to utilize the resources of the Trent Collection.

Upjohn Award. The award consists of \$200 cash and a certificate and is presented to a Duke graduating senior for excellence in community health science projects and service to the community.

Sandoz Award. This award is given to a senior student who has done distinguished work in basic science research or clinical research. Students will be nominated for this award by departmental chairmen with whom their work has been done. The work must have been presented at the AOA symposium and voted upon by the Awards Committee. It consists of a plaque and a check for \$100 and is limited to one student.

Ciba Award. This award is given to a third year student who has contributed to the health care of the community. Students are nominated by the student body and voted upon by them. The award consists of the complete set of medical illustrations and text by Frank Netter.

Other Awards. Throughout the year, Duke Medical School receives notification of awards consisting of books, money, and/or plaques or medals to be awarded to students in a variety of fields at all medical schools on a national competitive basis selected by committees of the sponsoring organizations. These awards are screened by the dean's office and publicized appropriately.

Admissions



Admission Procedures

Good study habits, intelligence, character, and integrity are essential qualifications for admission. Beyond this, premedical students should strive for an education that develops abilities to observe critically, think analytically, and work independently. Though a knowledge of basic scientific principles should be secured, the competence with which premedical students conduct their undergraduate careers is of more importance than the specific subjects which they study.

Application for Admission. The Duke University School of Medicine participates in the American Medical College Application Service (AMCAS). Application materials may be obtained from a premedical adviser or by writing: American Medical College Application Service, Association of American Medical Colleges, Suite 201, 2450 N Street, N.W., Washington, DC 20037-1131.

Upon receipt of the application materials from AMCAS, if credentials indicate, a supplemental application and other information will be mailed which will serve as notification of receipt of the application from AMCAS. Applications are received by AMCAS any time after 15 June until 15 October. Applicants are urged to file their applications as early as possible. Supplemental application should be returned within two weeks of receipt by the applicant.

Upon receipt of the supplemental application, two faculty members will determine whether or not to proceed with an interview.

Requirements. Admission to the School of Medicine requires a minimum of ninety hours of approved college credit including one year of college English or a university writing course, one year of inorganic chemistry, one year of organic chemistry, one year of physics, one year of biology and/or zoology, and one year of calculus. An introductory course in biochemistry during the senior year would be helpful. All science requirements must be completed not more than seven years prior to entrance.

The Medical College Admission Test, administered by the American College Testing Programs and Services, P.O. Box 414, Iowa City, Iowa 52240, is required of all applicants. This test is given in April and September of each year at numerous colleges throughout the United States. If possible, students should arrange to take this test in April of the year they plan to submit applications for admission.



Selection

The earliest date of notification of acceptance is in February for students entering the following August. Data on each candidate are carefully evaluated by the Committee on Admissions. A personal interview will be conducted at Duke for those students with satisfactory credentials. Candidates may have personal interviews with regional representatives of the Admissions Committee. Those candidates who demonstrate the most promise for exceptional performance in their future practice of medicine are admitted on the basis of merit. In order to ensure enrollment, accepted candidates must return a signed agreement and a \$50 deposit within three weeks after notification. Since admission is offered in advance of matriculation, it is provisional upon the successful completion of any incomplete premedical required subjects as well as the continued demonstration of scholarship in college course work.

Transfer

Duke University School of Medicine does not accept transfer students except in unusual circumstances.

Advanced Placement

Students who have been awarded Ph.D. degrees in biomedical or preclinical sciences may apply to be considered for a three-year program to obtain their M.D. degrees. This program consists of the core basic science courses required of all freshman medical students, core clinical rotations during the second year, followed by senior clinical electives. Students whose Ph.D.'s have not been awarded prior to expected matriculation are not eligible for this program.

Reapplication

Students who wish to apply for a second time should write AMCAS requesting new application forms. Supporting documents are transferred to the new application file. These documents are kept on file for three years.

Summary

Three years of college work, a fifty-five dollar (\$55) nonrefundable application fee, a fifty dollar (\$50) deposit within three weeks of notification of acceptance, and the Medical College Admission Test are required. The estimated class size in 1993-94 freshman class is 100.

Roster of Regional Representatives of Admissions Committee

Alabama:	<i>Birmingham</i> , Margaret M. Tarpey
Arizona:	<i>Tucson</i> , Ruth H. Capp Bell, David S. Shimm
Arkansas:	<i>Little Rock</i> , E. Clinton Texter, Jr., Larry W. Williams
California:	<i>Artesia</i> , Garrett F. Saikley; <i>Berkeley</i> , Bruce Africa; <i>Burlingame</i> , J. M. Javer, Andrew Nadell; <i>Carmichael</i> , John R. Dein; <i>Clayton</i> , Stanley Karansky; <i>Fairfield</i> , William R. Nesbitt; <i>Fontana</i> , Henry L. Burks; <i>Irvine</i> , A. Brian Davis; <i>La Jolla</i> , Herman F. Froeb; <i>Los Angeles</i> , Walter Lusk, Kenneth P. Ramming, Douglas F. Smiley; <i>Redlands</i> , Perry Dyke; <i>Redwood City</i> , John B. Simpson; <i>Sacramento</i> , Sidney M. Gospe, Jr.; <i>San Diego</i> , Lars Erickson, Stuart B. Kincaid, Robin E. Rutherford, Donald J. Williams; <i>San Francisco</i> , Robert Kahn, R. Gray Patton, Henry Safrut; <i>Walnut Creek</i> , David S. Forth
Colorado:	<i>Denver</i> , Frederick L. Grover, Michael J. Jobin, York E. Miller; <i>Englewood</i> , Bertram Goldberg
Connecticut:	<i>New Haven</i> , G. P. Beardsley, David J. Goodkind, Stephen J. Huot
District of Columbia:	<i>Jonca C. Bull</i> , Linda D. Green, Kurt D. Newman
Florida:	<i>Gainesville</i> , Jerry Berger, William F. Cassano, Timothy R. S. Harward, Alan Klein, Steve Roark; <i>Hallandale</i> , Norman Moskowitz; <i>Miami Beach</i> , Stephen W. Unger; <i>South Miami</i> , Leonard A. Kalman; <i>Tampa</i> , Richard G. Connar, Americo A. Gonzalvo, Douglas Reintgen
Georgia:	<i>Atlanta</i> , R. Wayne Alexander, Crawford F. Barnett, Jr.
Hawaii:	<i>Honolulu</i> , John Mickey; <i>Kealahou</i> , Thomas E. Austin; <i>Wahiawa</i> , Ned Stoughton
Illinois:	<i>Barrington</i> , George Pepper; <i>Chicago</i> , John H. Buehler, Herbert Engelhard, George H. Gardner, Daniel J. Pachman, John D. Utley; <i>Elk Grove Village</i> , Gary E. Kay; <i>Geneva</i> , Charles A. Hanson; <i>Park Ridge</i> , Earl N. Solon
Indiana:	<i>Indianapolis</i> , Mark O. Farber, C. Conrad Johnston, Jr.
Kansas:	<i>Lenexa</i> , David L. Smith
Louisiana:	<i>Baton Rouge</i> , Karen H. Miller; <i>New Orleans</i> , Nancy Haslett
Maryland:	<i>Olney</i> , Joseph Buffington



Massachusetts:

Boston, Ann W. Crosson, Matthew W. Gillman, Paula Kadison, Richard Kopelman, Brit Nicholson, Stephen A. Sohn; *Cambridge*, Paul N. Chervin, K. Lea Sewell; *Hyannis*, Linda A. Bishop; *Newton Centre*, Bernard Levy; *Waltham*, Desiree Carlson; *Wellesley*, George King; *Worcester*, Katherine S. Upchurch

Michigan:

Ann Arbor, George M. Lyon, Jr.; *Detroit*, John J. Fath; *Flint*, Melissa Hamp; *Grosse Pointe*, John M. Lesesne

Minnesota:

Lauderdale, Christian T. Campos; *Minneapolis*, James Halikas

Missouri:

Kansas City, Gerry Woods; *Springfield*, C. Norman Shealy; *St. Louis*, Scott J. Anderson, W. Edwin Dodson; *Webster Groves*, Julia L. Stevens

Nebraska:

Omaha, Linda K. Matson

New Hampshire:

Concord, Joseph R. Snow; *Exeter*, Eric D. Lister; *Hanover*, John Modlin

New Jersey:

Hackensack, Steven P. Honickman; *Moorestown*, Michael S. Entmacher; *Morristown*, Neal D. Shore; *Pompton Plains*, Charles W. Ross; *Princeton*, Timothy Patrick-Miller; *Summit*, Wayne Sidman Barber; *Watchung*, R. Christopher Stucky

New York:

Bronx, Steven R. Savona; *Ithaca*, John G. Maines; *New York*, David S. Goldman, Bruce Horten, Lenard E. Jacobson, Cynthia L. Krause, Michael J. Lepore, Nathan St. Amand, David N. Silvers; *Rhinebeck*, Catherine Toye; *Rochester*, Phyllis C. Leppert, Douglas K. Slater

Ohio:	<i>Akron</i> , Robert W. Novak; <i>Cincinnati</i> , Donald Rucknagel; <i>Cleveland</i> , Stephen E. Alpert; <i>Columbus</i> , Miles E. Drake, Jr.; <i>Elyria</i> , William L. Hassler
Oklahoma:	<i>Oklahoma City</i> , James R. Gavin III, Richard L. Reece; <i>Tulsa</i> , James A. Young
Oregon:	<i>Portland</i> , Marcia Freed
Pennsylvania:	<i>Johnstown</i> , W. Frederick Mayer; <i>Lansdowne</i> , Cathy Wiley, Jim Wiley; <i>Philadelphia</i> , Christopher V. Chambers, Mary Ann Forciea, John J. Furth, David M. Goodner, James R. Harp, Richard I. Katz, Sheila M. Katz, Graham E. Quinn, Mona M. Shangold; <i>Pittsburgh</i> , Richard L. Green, Martin A. Morse, Michelle Roberts; <i>Rydal</i> , Anthony J. Limerakis; <i>State College</i> , Richard H. Dixon, Donald F. Mandetta; <i>Wynnewood</i> , Frank Kern
Rhode Island:	<i>Lincoln</i> , Henry G. Magendantz; <i>Providence</i> , Benjamin T. Jackson
South Carolina:	<i>Columbia</i> , Ben Miller
Tennessee:	<i>Chattanooga</i> , Roger G. Vieth; <i>Memphis</i> , Peter D. Jones; <i>Nashville</i> , Alexander C. McLeod
Texas:	<i>Dallas</i> , Paul Pin, William Shapiro; <i>Galveston</i> , J. Andrew Grant, Jr.; <i>Houston</i> , Robert B. Bressler, Madeline Duvic, Kenneth Gould, Jr., Barry N. Hyman, Eugenia Kleinerman, Leonard A. Zwelling; <i>Plano</i> , Alan D. Davis
Utah:	<i>Salt Lake City</i> , Ralph Whatley
Virginia:	<i>Alexandria</i> , Andrea M. Jackson
Washington:	<i>Auburn</i> , Joseph Gehrett; <i>Kirkland</i> , David Pitkethly; <i>Renton</i> , Wallace H. J. Chang; <i>Seattle</i> , Gregory J. Raugi; <i>Woodinville</i> , Alice M. Ormsby

Financial Information



Fees and Expenses

Tuition. The following table represents an estimate of a student's necessary expenses in the School of Medicine. The total of these figures suggests a basic minimum budget of approximately \$27,000. These are estimated figures only and are based on a survey of enrolled students. Tuition and fees are subject to change without notice. Allowances for recreation, travel, clothing, and other miscellaneous items must be added to this estimate with allowances for individual needs and tastes.

Tuition: Years 1, 2 and 3	\$18,500
Year 4	17,000
Accident and Sickness Insurance+ (subject to change)	545
First Year Fee+ (includes microscope rental, first year only)*	275
Annual Cost of Books and Supplies: first year	1,395
Annual Cost of Books and Supplies: second year	1,242
Annual Cost of Books and Supplies: third and fourth year	587
Lodging	3,800
Board: first year	3,055
Board: second year	3,888
Board: third and fourth year	2,499
Student Health Service+ \$178 per semester	356
Student Government+ (Davison Society)	50
Continuation of Enrollment Fee‡	35
Graduate Student Fee+	10
Motor Vehicle Registration	55

*Sphygmomanometer, ophthalmoscope, otoscope, and other equipment required of each student must conform to rigid standards.

+Mandatory fees.

‡The School of Medicine encourages students to interrupt their studies to pursue approved educational endeavors complementary to the medical curriculum at Duke or elsewhere for no credit. To retain full-time student status for loan deferment purposes, students may seek approval to enroll in the Continuation of Enrollment option. Only students eligible to be enrolled at Duke during the applicable time period may participate.

Tuition and fees are payable on a semester basis and all students are required to pay full tuition for four years as a requirement for graduation. For the freshman year, one-half of the annual tuition and fees is billed in July and the other one-half in December. Students who must repeat 60 percent or more of the required first year courses pay full tuition while prorated tuition is paid by those repeating less than 60 percent of those courses. Second year students are billed at the rate of one-seventh of the annual tuition and fees for the Introduction to Clinical Diagnosis and each eight-week rotation and one-fourteenth of the annual tuition and fees for each four-week rotation. Juniors and seniors are billed for a total of

sixty-four (seventy-two*) credits during the elective years. Distribution of tuition charges depends upon the number of credits for which a student is registered each term. Cost per credit is obtained by dividing the annual tuition by thirty-two (thirty-six*), half the number of elective credits required for graduation. No tuition is charged for elective credit taken in excess of the sixty-four (seventy-two*) required to obtain the M.D. degree provided the credit is taken within the same semester in which the student completes graduation requirements. Please note, however, that the student is no longer eligible to receive financial aid funding after he or she has completed the sixty-four (seventy-two*) elective credits.

Payment of Accounts for Fall and Spring. Monthly invoices for tuition, fees, and other charges are sent by the bursar's office and are payable upon receipt but no later than the late payment date. As a part of the agreement of admission to Duke University, a student is required to pay all invoices as presented. No deferred payment plans are available. If full payment is not received by the late payment date, a late payment charge as described below is assessed on the next invoice and certain restrictions as stated below are applied. Failure to receive an invoice does not warrant exemption from the payment of tuition and fees nor from the penalties and restrictions. Nonregistered students are required to make payment at the time of registration for tuition and fees and any past due balance on the account.

Late Payment Charge. If the "Total Amount Due" on an invoice is not received by the late payment date, the next invoice shows a penalty charge of 1 1/4 percent per month assessed on the past due balance regardless of the number of days past due. The "Past Due Balance" is defined as the previous balance less any payments and credits received on or before the late payment date and also any student loan memo credits related to the previous balance which appear on the invoice. The amount of the 1 1/4 percent penalty charge is the same regardless of the number of days payment is received after the late payment date.

Restrictions. An individual is in default of this agreement if the total amount due on the student invoice is not paid in full by the invoice late payment date. An individual who is in default is not allowed to register for classes, receive a transcript of academic records, have academic credits certified, be granted a leave of absence or receive a diploma at graduation. In addition, an individual in default may be subject to withdrawal from school.

No credit is given for any term in which the tuition has not been paid, whether the work has been at Duke or elsewhere. It is not advisable for students to attempt outside work to defray their expenses during the academic year. Spouses of medical students desiring employment may secure information from the Duke University Personnel Office.

Fall and Spring Refunds. Tuition and fees refunds are governed by the following policy:

1. In the event of death a full tuition and fees refund will be granted.
2. In all other cases of withdrawal or leaves of absence, students or their parents may elect to have tuition refunded or carried forward as a credit for later study according to the following schedule:
 - a. withdrawal before the beginning of classes—full refund;
 - b. withdrawal during the first or second week—80 percent;
 - c. withdrawal during the third through fifth week—60 percent;
 - d. withdrawal during the sixth week—20 percent;
 - e. withdrawal after the sixth week—no refund;
 - f. tuition charges paid from grants or loans will be restored to those funds on the same pro rata basis and will not be refunded or carried forward.

*Applies to students completing third year requirements prior to fall semester, 1993.

3. In the case of changing category from full-time to part-time, dropping special fee courses (music, art, golf, etc.), or dropping audit courses, a full refund is granted during the drop/add period. Subsequent to the drop/add period changes of category are not allowed. Students may, however, withdraw from courses after the drop/add period with no refund or add new courses if the proper tuition is paid.

Continuation of Enrollment Fee. The School of Medicine encourages students to interrupt their studies to pursue approved endeavors that are complementary to the medical curriculum either at Duke or elsewhere for no credit. Full-time student status can be retained for a maximum period of two years during these periods of study if approval is obtained from the appropriate officials and the student registers for and pays an enrollment fee of \$35.00 for each semester or part of a semester away. No refund of any portion of the fee is allowed for students who subsequently withdraw from the School of Medicine.

Although considered to be full-time by the Duke School of Medicine, financial aid recipients should be aware that such status may not be recognized by lenders for loan deferment purposes.

Only students eligible to be enrolled at Duke during the applicable time period may participate in this option.

Transcripts. Requests for transcripts of academic records should be directed to the Office of the Medical Center Registrar. A fee of three dollars, payable in advance, is charged for each copy. However, the transcript fee is waived for financially needy students who require transcripts to apply for external funding. After graduation from the School of Medicine, transcripts of deans' letters may also be obtained from the Office of the Registrar for the fee of one dollar per copy.

Living Accommodations

Housing Costs. For the 1993-94 academic year, rental rates for the first-year medical student are projected to be \$3,357 for the Town House apartments. Utility charges, except telephone, are included in these rates.

Rental rates in Central Campus Apartments for the 1993-94 academic year are projected to range from \$2,850 to \$4,402 for single first-year medical students. Utility charges, except telephone, are included in the Central Campus Apartment rates. These rates are per person per academic year.

A deposit is required with all applications. The deposit is not refunded if cancellation is received after an assignment is made.

Refunds of rent are calculated in accordance with the procedures published by the Department of Housing Management.

Food and Other Expenses. Duke Dining Services and Duke University Store operations are located on campus to service the needs of the Duke community. For the convenience of students, the university identification card, called The Duke Card, can be used to access prepaid accounts and make purchases in these facilities.

There are two kinds of accounts: the dining account, which can be used for food purchases only, and the flexible spending account, which can be used to purchase not only food, but any items sold by Duke stores, such as books, supplies, laundry services, health and beauty aids, and more. These campus retail operations also accept cash.

For more information about establishing an account, contact The Duke Card Office, 024 Union West, Duke University, Durham, North Carolina 27706 919/684-5800.

Motor Vehicle Registration

Each motor vehicle operated on Duke University campuses by students enrolled in the School of Medicine must be registered at the Medical Center Traffic Office, PRT Level, Parking Deck II, within five days after operation on the campus begins, and thereafter must display the proper registration decal.



All students must pay an annual fee of \$50 for each four-wheeled motor vehicle and \$50 for each motorbike or motor scooter registered. Bicycles are registered free of charge at the Public Safety Department, 2010 Campus Drive.

To register a vehicle, the student must present a valid state registration for each vehicle registered and a valid state operator's license.

Parking, traffic, and safety regulations are given each student at the time of registration of the vehicle(s). Students are expected to abide by these regulations.

Merit Awards for Medical Students

The School of Medicine offers awards to students from the following scholarships based solely on academic excellence:

William G. Anlyan, M.D. Scholarship, established 1988 by gifts from faculty, staff and friends.

Barham Endowed Merit Fund, established November, 1984, by gift from Mr. and Mrs. Joseph Barham, Oak Ridge, Louisiana.

Family Dollar Scholarship, established November, 1984, by gift from Mr. Leon Levine, Chairman of the Board, Family Dollar Stores, Inc., Charlotte, North Carolina; for minority students.

Dr. William Redin Kirk Memorial Trust for North Carolinians, established March, 1984, by bequest of Mr. Frederick H. Pierce, Owensboro, Kentucky.

Dr. Kenneth L. Pickrell Scholarship, established February, 1984, by gift from the Department of Surgery, Duke University Medical Center.

School of Medicine Merit Fund, established 1984 by gifts from medical alumni, students, and American Medical Association-Education and Research Foundation.

Financial need is not a criteria for selection; however, applicants who feel their financial need is greater than the merit award may apply for financial aid.

The Dean's Tuition Scholarships. Seven Dean's Tuition Scholarships in the amount of current tuition are given to academically excellent freshmen minority students each year. Preference is given to residents of North Carolina. Selection is made by the dean based on recommendations from the Medical School Admissions Office. Annual renewal is contingent upon satisfactory academic progress.

Medical Student Research Scholarships

Several groups now sponsor medical student research scholarships. In most of the scholarship programs, students selected for scholarships are eligible to receive thirty-two (if completed prior to the fall 1993 semester, thirty-six or in some instances forty) basic science credits for the experience.

Some have delegated the responsibility to the medical school to select participants in the program, others have their own independent selection processes. A full twelve months is required for the research experience. Selection for the following awards is made by the Student Research Scholarship Committee.

Eugene A. Stead Student Research Scholarship Program. This program is sponsored by the Duke Department of Medicine in honor of Eugene A. Stead, Jr., M.D., chairman of the Department of Medicine from 1947 until 1967. Three students are selected each year as General Stead Scholars and six others will be selected during 1992-93 as Stead Scholars in special areas as indicated below. Two of the General Stead Scholarships are supported by endowments from individual patients of Dr. James Clapp-Jay D. and Lorraine Nicewonder and the Loo Cheng Ghee family. The third general scholarship is supported by an endowment by those at Duke and elsewhere who were trained in Internal Medicine by Dr. Stead. The Robert T. and Virginia McDaniel-Stead Scholarship is an endowed scholarship intended to support basic cardiovascular research. The McDaniels are patients of Dr. Andrew Wallace. The Hartford-Stead Scholarships encourage the pursuit of careers in geriatrics and will be awarded to two students with research proposals and career goals relating to the health of elderly. The Duke University Cooperative Cardiology Society (DUCCS) and Nancy B. Wagner scholarships support students in cardiovascular research and the Herbert O. Seiker scholarship supports a student in pulmonology research.

Four School Physician Scientist Program in Internal Medicine. The Departments of Medicine of Duke University, Johns Hopkins University, University of Pennsylvania and Washington University in St. Louis have begun a special program designed to promote the development of medical scientists. Provision will be made for two students from each school to be selected to spend one year in research while in medical school, two years in residency in internal medicine, and two years of postdoctoral training in research at one or more of the participating institutions. Financial support will be provided for both the research and clinical components of this program.

The Cassell-Saperstein Scholarship Endowment Fund. This fund, provided by the Cassell-Saperstein family, funds an annual scholarship to a student involved in any basic research area in the medical sciences.

Stanley J. Sarnoff Society of Fellows for Research in Cardiovascular Sciences. Ten students are chosen nationally for a full twelve-month research experience in the cardiovascular area, away from their parent medical school. Duke has one position in this program. The program is in its twelfth year and there is a great deal of esprit de corps within the "Sarnoff Society of Cardiovascular Fellows." There is an annual meeting in Bethesda, Maryland, in which the ten fellows engaged in research during that year present their work, fellows who have completed their research year talk about their developing career plans, and newly selected fellows learn about possible research opportunities.

The American Heart Association Medical Student Research Fellowship Program. Duke is one of twenty-five schools selected by the American Heart Association for one of their

Student Research Scholarship Programs. Two positions each year are available. These scholarships differ from all others in that the funding organization does not permit the student to receive academic credit while they are American Heart Scholars. Therefore, these scholarships have been used by students who had rewarding experiences during their basic science elective year in cardiovascular research and then chose to add a second dedicated research year before completing their clinical elective year as a Duke medical student.

All students applying to these programs prepare their applications and receive interviews during the second year of medical school. Announcements of the scholarship recipients are made in April.

In addition, there are other foundations which support student research scholarship programs and are approved for Duke University School of Medicine credit but have their own methods for evaluation and selection. Because of the unique nature of the Duke University School of Medicine curriculum, we have been highly successful in having students in the various programs. The Howard Hughes/National Institutes of Health Research Scholars Program and the Pew Foundation/Rockefeller University Program require that the student works in a particular institution away from their parent medical school. The Hughes/NIH program selects thirty students each year to live on the NIH campus and work in one of their basic science laboratories. During 1991-92 four of these positions were occupied by Duke students. The Pew/Rockefeller program selects four students each year to work in laboratories studying various aspects of human nutrition at the Rockefeller University in New York City. We have also been very successful in having our students in scholarship programs supported by the Arthritis Foundation, the Pharmaceutical Manufacturers Foundation, and the Fight for Sight Foundation. The Howard Hughes Medical Institute initiated a new research training program which permits the students to work in any laboratory of their choice including those at their parent school. Sixty of these were awarded in 1991-92, ten of whom are Duke students.

During the 1991-92 academic year twenty-six of one hundred students in the third year class received scholarships for research training in their basic science elective year.

Financial Aid

The Duke University School of Medicine makes financial assistance available to accepted students who, due to economic circumstances, could not otherwise attend the university. The school recognizes, however, the responsibility of the individual and the family to provide funds to achieve the objective of a medical education. Thus, the school does not consider that parents have discharged the full financial obligation for the continuing education of their sons or daughters upon the latter's completion of the undergraduate degree.

Financial assistance is available in a combined form of grants and loans, and all awards are made on the basis of demonstrated need.

Financial Assistance to Incoming Freshmen. A financial aid application packet is routinely mailed in January to applicants who have been interviewed. This mailing is without regard to whether the applicant expressed an interest in assistance on the application for admission. The economic circumstance of the applicant has no bearing on whether the applicant is accepted into the medical school.

The applicant requesting financial aid is expected to work during the summer preceding entrance into medical school and to save part of those earnings to defray a portion of the first-year expenses.

The applicant's need is determined before an award is made. The Office of Financial Aid, therefore, requires the Duke University Medical Center application for financial aid and computations from the GAPSFAS form in addition to the Free Application for Federal Student Aid (FAFSA). Copies of federal income tax returns with supplemental schedules and a financial aid transcript are also required as part of the financial aid application.

An official aid award notice is sent to the accepted applicant within a few days after receipt of the required forms. Awards are conditional until all required documents are received.

The present financial aid package, which is subject to change, for qualified North Carolinians (those who meet state residency law prior to matriculation) is based on a tuition grant up to \$10,000. Financial need in excess of \$10,000 must come next from a \$5,000 Stafford student loan (formerly GSL), and need in excess of \$5,000 comes from one-half school grant and one-half Stafford student loan up to \$2,500, then Duke loan. For eligible students entering fall 1990, and those matriculating thereafter, the maximum tuition grant is \$11,750.

The present financial aid package, which is subject to change, for qualified students from outside North Carolina is based on a \$5,000 Stafford student loan. Financial need in excess of \$5,000 comes from one-half school grant and one-half from Stafford student loan up to \$2,500, then Duke loan.

Financial Assistance to Upperclassmen. Annual reapplication is required of all need based aid recipients. Upperclassmen seeking financial assistance for the first time may consult with the Administrator of Financial Aid.

Duke University Medical Center Endowed Funds.

Barney Baker and Minnie P. Baker Endowed Scholarship Fund, established March, 1992, by bequest of their son Barry Baker.

Charles W. Banner Loan Fund, established in 1953 by a gift from Mrs. Edward B. Benjamin.

Germain Bernard Scholarship, established in 1959 by the B. C. Remedy Company.

Thomas C. Bost Scholarship, established in 1965 by a gift from Dr. Thomas C. Bost, supplemented by subsequent gifts.

Franklin and Louise Brown Medical Scholarship, established March, 1992, by bequest of Franklin and Louise Brown.

Elizabeth Burgess Bressler Memorial Scholarship Fund, established in 1983 by her children: Garrett S. Bressler, M.D.; Robert B. Bressler, M.D.; Barbara B. Marques; Peter B. Bressler, M.D.

James L. Clark Memorial Scholarship, established in 1965 by a gift from Mr. and Mrs. Marvin D. Clark and supplemented by gifts from other donors.

C. T. Council Scholarship, established in 1959 by the B. C. Remedy Company.

Helen M. Curtis Endowed Scholarship Fund, established June, 1992, from the estate of Helen M. Curtis.

John H. Dorminy Scholarship, established in 1980 by gift from John H. Dorminy, Jr.

Herbert T. Dukes, M.D. Memorial Loan Fund, established in 1983 by his classmates and friends.

Eagles-Andrews Memorial Scholarship, established in 1982 by a gift from Dr. and Mrs. William M. Eagles.

William F. Franck Memorial Scholarship, established in 1958 by gift from William F. Franck, Jr. '39, and supplemented by additional gifts.

Constance I. Gottwald Medical Scholarship, established 1987 with preference for minority students by gift from Constance I. Gottwald.

Hazel Endowment Fund, established 1984 by gift from Mr. and Mrs. William A. Hazel.

Warren W. Hobbie Fund, established in 1980 by trustees of the Warren W. Hobbie Charitable Trust.

Earl P. Holt, Jr. Memorial Scholarship, established 1986 by gift from family and friends for first or second year medical students with preference given to minority students.

George Lee Hundley and Rebecca Barnhill Hundley Fund, established in 1980 by gift from George Lee and Rebecca Barnhill Hundley.

H. B. and Adelaide F. Ingle Medical Scholarship, established in 1976 by gift from Mr. and Mrs. Harry B. Ingle.

B. Everett Jordan Scholarship, established in 1974 by the late Senator B. Everett Jordan and his widow, Katherine Jordan.

Thomas D. Kinney, M.D. Memorial Scholarship, established in 1980 by gifts from his widow, Dr. Eleanor R. Kinney, and their children: Thomas R. Kinney, M.D.; Eleanor D. Kinney, J.D.; Hannah C. Kinney, M.D.; and Janet S. Kinney, M.D.

Dr. John Haden Lane Memorial Scholarship, established in 1968 by gift from Edward H. Lane Foundation.

E. C. Langston Medical Scholarship, established in 1979 by bequest of Mrs. Denzil L. Mosteller.

Paul E. Leviton Medical Scholarship, established in 1981 from the estate of Paul E. Leviton.

James Cecil McGehee Memorial Medical Scholarship, established in 1975 by gift from C. G. McGehee, Jr.

Medical Alumni Scholarship, established in 1974 by Duke Medical Alumni.

Medical Class of 1950 Fund, established in 1980 by gifts from graduates of 1950.

Medical Class of 1981 and AESCULAPIAN/80 Staff, established in 1980.

Medical School Faculty Wives Scholarship, established in 1968 by a gift from the Medical School faculty wives whose source of funds is proceeds from the Nearly New Shoppe.

John F. Ott Endowment Fund, established in 1984 by bequest of John F. Ott, M.D., 1943.

Henry A. Page Scholarship Fund, established 1942 by gift from Henry A. Page, Jr., and Gertrude Wetherill Page.

Physical Medicine Scholarship, established in 1963 by gift from Central Carolina Convalescent Hospital, Inc., Greensboro, North Carolina.

Radiological Science Medical Student Loan Fund, established in 1980 by the Department of Radiology.

Senior Class Gift, established by graduates of classes of 1977 and 1978.

Melvin D. and Judith N. Small Medical School Scholarship Fund was established in 1976 by gift from Dr. Melvin D. and Mrs. Judith N. Small.

Sigmund Sternberger Endowment Fund, established in 1978 by gift from the Sigmund Sternberger Foundation, Inc., Greensboro, North Carolina.

William E. Stevens, Jr. Scholarship, established in 1983 by the Broyhill Foundation, Lenoir, North Carolina.

B. W. Stiles Scholarship, established in 1981 by gift from the Mary Duke Biddle Foundation.

Francis and Elizabeth Swett Scholarship, established in 1966 by gift from the late Dr. and Mrs. Swett.

Larry and Violet H. Turner Scholarship, established 1977 by gift from Drs. Larry and Violet H. Turner.

Dr. Hillory M. Wilder Memorial Scholarship, established in 1962 by bequest from Celeste Wilder Blake and Kenneth M. Blake.

Sue Eggleston Woodward Memorial Scholarship, established in 1966 by gifts from parents, relatives, and friends.

Vivian Zirkle Memorial Scholarship, established in 1981 by gift from Drs. Lewis and Sara Zirkle.

Other Medical School Scholarships. Mary Duke Biddle Foundation Scholarships, Duke University School of Medicine Scholarships, State of North Carolina (tuition remission up to \$2,000), and the Lettie Pate Whitehead Foundation.

Federal Scholarships. Armed Forces (Army, Navy, and Air Force) Scholarship programs may be available for accepted or enrolled students. The recipient receives full tuition, fees, and a monthly stipend in return for a commitment of service as a physician for each year of funding. The special application is made directly to the program in which the student is interested.



Scholarships for Students of Exceptional Financial Need. This federally funded program provides grant assistance to schools for students who qualify on the basis of federal criteria. Recipients, who are selected by the school, must have zero family resources as measured by a nationally recognized need analysis and must practice in a primary care field for five years after completion of residency training.

Financial Aid for Disadvantaged Health Professions Students (FADHPS). Recipients for this federally funded grant program are selected by the school on the basis of federal criteria. The student must have zero family resources as measured by a nationally recognized need analysis and must practice in a primary care field for five years after completion of residency training.

North Carolina Board of Governors Medical Scholarships. Board of Governors Medical Scholarships (BGMS) are awarded annually to twenty first-year medical school candidates who have been accepted for admission at one of the four medical schools in North Carolina. BGMS recipients are selected from among candidates of all races who are financially disadvantaged state residents and who have expressed an interest in practicing medicine in the State of North Carolina. The awards provide a yearly stipend of \$5,000 plus tuition and all mandatory fees other than that of the Sickness and Accident Insurance. Coverage of the

insurance fee is determined on a yearly basis according to available resources. The BGMS may be renewed for four years. Information about the scholarship may be obtained from the Financial Aid Office.

Loans

University loans are available under the specific restrictions of the loan funds and are awarded on the basis of financial need. Some of them are: W. K. Kellogg Foundation Loan Fund, Seaborn L. Hardman Loan Fund, Medical Freshman Tuition Loan, Scott Loan Fund, Charles W. Banner Loan Fund, Carl Perkins Student Loans, Radiological Science Medical Student Loan Fund, and U. S. Health Professions Student Loans.

The Francis and Elizabeth Swett Loan Fund is an emergency loan available in small amounts to any medical student on a no-interest basis for a short period of time.

Loans from Outside the University

North Carolina Student Loan Program for Health, Science, and Mathematics. These loans provide financial assistance to North Carolina residents who demonstrate need as determined by the board. Loans are available for study in the medical fields, mathematics, and science programs that lead to a degree. The applicant must be a domiciliary of North Carolina and accepted as a full-time student in an accredited associate, baccalaureate, master's, or doctoral program leading to a degree. Loan recipients in some professional or allied health programs may cancel their loans through approved service in shortage areas, public institutions, or private practice. Medical students may receive up to \$7,500 per year for each of the four years; master's degree students are eligible for two loans of up to \$5,000 each; bachelor's degree students are eligible for three loans of up to \$4,000 each. For application forms and more information write: Executive Secretary, North Carolina Student Loan Program for Health, Science, and Mathematics, P. O. Box 20549, Raleigh, North Carolina 27605, or telephone 919/733-2164.

Health Education Assistance Loans. These need-based loans are available to accepted or enrolled students. There is an annual maximum, and interest, which is higher than the rate for most need-based loans, is not subsidized during enrollment. The special application and more information is available in the Financial Aid Office.

Stafford Student Loans (formerly GSL). The need-based Stafford Student Loan is available to eligible students through many home-town banks and/or state agencies. The annual maximum for medical students is \$8,500 with an aggregate maximum of \$65,500. The interest is federally subsidized until repayment begins six months after graduation. A five percent loan origination fee on the amount of the loan is required.

Additional information, including a financial aid brochure and approved student budgets, may be obtained by writing to Mrs. Nell Andrews, Administrator, Financial Aid, Box 3067, Duke University Medical Center, Durham, North Carolina 27710.



Courses of Instruction



Anesthesiology

Professor: Joseph G. Reeves, M.D. (Med. Coll. of South Carolina, 1969), *Chairman*.

Professors: Peter B. Bennett, Ph.D., D.Sc. (Southampton, England, 1964); Joannes H. Karis, M.D. (State Univ. of Utrecht, Holland, 1952); William J. Murray, Ph.D. (Wisconsin, 1955), M.D. (North Carolina at Chapel Hill, 1962); Lloyd F. Redick, M.D. (Ohio State, 1958); Bruno J. Urban, M.D. (Albertus Magnus, Germany, 1960); Stanley W. Weitzner, M.D. (New York Coll. of Med., 1953).

Associate Professors: Edmond C. Bloch, M.B., Ch.B. (Univ. of Cape Town, South Africa, 1946); Norbertus P. de Bruijn, M.D. (Univ. of Groningen, The Netherlands, 1976); Cecil O. Borel, M.D. (Hahnemann, 1977); William J. Greeley, M.D. (Texas at Houston, 1976); Jonathan B. Mark, M.D. (Stanford, 1978); Richard E. Moon, M.D., C.M. (McGill, 1973), M.Sc. (Univ. of Toronto, 1979); Robert Lawrence Reed, M.D. (Virginia, 1976); Sidney A. Simon, Ph.D. (Northwestern, 1973); Robert N. Sladen, M.B., Ch.B. (Univ. of Cape Town, South Africa, 1970), M.R.C.P. (Royal Postgrad. Med. Sch., 1973).

Assistant Professors: Andrew T. Canada, Pharm.D. (Philadelphia Coll. of Pharmacy and Science, 1968), Ph.D. (Massachusetts, 1985); Fiona Clements, M.D. (Duke, 1975); Guy de Lisle Dear, M.B., Ch.B. (St. George's Hospital, London, England, 1979); Ronald D. Edgar, M.D. (University of Manitoba, Canada, 1981); Thomas A. Fawcett, M.D. (Duke, 1986); Jennifer T. Fortney, M.D. (Maryland, 1978); Brian Ginsberg, M.B., B.Ch. (Univ. of Witwatersrand, South Africa, 1975); Peter Glass, M.B., B.Ch. (Univ. of Witwatersrand, Johannesburg, South Africa, 1976); H. David Hardman, M.D. (Minnesota, 1981); Lewis R. Hodgins, M.D. (New York, Downstate, 1985); Peter C. Huttemeier, M.D., Ph.D. (University of Copenhagen, Denmark, 1977, 1989); James R. Jacobs, Ph.D. (Alabama at Birmingham, 1987); Rajiv Jhaveri, M.B. (Gujarat Univ., India, 1977); Frank H. Kern, M.D. (Pennsylvania, 1987); Bruce Leone, M.D. (Florida, 1982); John B. Leslie, M.D. (Duke, 1976); David Lubarsky, M.D. (Washington Univ., 1984); Jon N. Meliones, M.D. (Tufts, 1984); Andrew Meyer, M.D. (New York, Downstate, 1969); Mark F. Newman, M.D. (Louisville, 1985); Stephen Parrillo, M.D. (University of Bologna, Italy, 1982); Claude Piantadosi, M.D. (Johns Hopkins, 1975); Ziaur Rahman, M.B. (Prince of Wales Med. Coll., India, 1968); Scott R. Schulman, M.D. (George Washington, 1982); Debra A. Schwinn, M.D. (Stanford, 1983); Dianne L. Scott, M.D. (North Carolina at Chapel Hill, 1978); Lloyd R. Smith, Ph.D. (Alabama, 1985); William Francis Spillane, M.D. (New Jersey, 1984); Thomas E. Stanley III, M.D. (Duke, 1981); Susan Steele, M.D. (Illinois, 1983); Timothy H. J. Webb, M.D. (Texas at San Antonio, 1980), Ph.D. (Texas at San Antonio, 1974).

Assistant Research Professors: Wayne A. Gerth, Ph.D. (California at San Diego, 1979); Joel S. Goldberg, M.D. (Duke, 1977); Uta Schambra, Ph.D. (North Carolina at Chapel Hill, 1988); Ying-Fu Su, Ph.D. (Colorado, 1978); Richard Vann, Ph.D. (Duke, 1976); Yu-Ting Xuan, M.D. (Shan-xi Medical College, China, 1977), Ph.D. (Duke, 1990).

Assistant Clinical Professor: Judy Margolis, M.D. (Colorado, 1984).

Associate Clinical Professors: Elisabeth J. Fox, M.B., B.S. (London Univ., 1955); Brian J. McGrath, M.D. (Albany, 1982).

Associates: Mark Dentz, M.D. (Michigan, 1989); Salim Ghazi, M.D. (French Faculty of Medicine, Lebanon, 1986); Veeraindar Goli, M.B., B.S. (Osmania Medical College, Hyderabad, India, 1978); Katherine Park Grichnik, M.D. (Tufts, 1987); Caryn Hertz, M.D. (Rochester, 1986); Catherine K. Lineberger, M.D. (North Carolina at Chapel Hill, 1987); Michael Lee Maynor, M.D. (Louisville, 1982); Kathryn E. Phillips, M.D. (North Carolina at Chapel Hill, 1988); Allison Lee Ross, M.D. (Marshall, 1988); Thomas F. Slaughter, M.D. (Duke, 1987); Bret Stolp, M.D. (North Carolina at Chapel Hill, 1988), Ph.D. (Duke, 1985); Christopher C. Young, M.D. (New York Med. Coll., 1987).

Adjunct Professor: Kwen Jen Chang, Ph.D. (New York at Buffalo, 1972).

Associate Consulting Professor: Edward T. Thomas, M.B., B.S. (London, 1949), M.R.C.S., L.R.C.P. (England, 1948), F.F.A.R.C.S. (England, 1954).

Assistant Consulting Professors: John J. Freiburger, M.D. (Southwestern, 1979); Michael S. Gorbach, M.D. (Maryland, 1979); Rolf B. Wallin, M.D. (North Carolina at Chapel Hill, 1984).

Adjunct Assistant Professor: Fritz F. Klein, Ph.D. (Duke, 1973); John R. Plachetka, Pharm. D. (Illinois, 1977).

Visiting Associates: Philip Braithwaite, M.B., Ch.B. (Dundee Univ. Med. School, Tayside, Scotland, 1980); I. J. Broome, M.B., Ch.B., FCAnaes. (Manchester, England, 1984); Michael Brunner, M.B., B.S. (St. Bartholomew's Hospital Med. School, University of London, England, 1986); Michael Copp, M.B., B.S., FCAnaes. (King's England, 1983); Suresh Dorairaj, M.B., B.S. (Univ. of Madras, India, 1976); Ann Downing, M.B., B.S. (Saint Georges', England, 1984); T. J. Gan, M.B., B.S., D.A., FCAnaes. (London Hospital Medical College, 1986); Adam C. Hill, M.B., B.S., FCAnaes. (Charing Cross, England, 1983); Andrew K. Hilton, M.B., B.S. (Univ. of New South Wales, Australia, 1983); Pradip Joshi, M.B., B.S. (Westminster Med. School, Univ. of London, England, 1982); Atul Kapila, M.B., B.S., B.Sc., FCAnaes. (Middlesex, England, 1984); Ho Yeong Kil, M.D. (Kyung Hee Univ., Seoul, Korea, 1978), Ph.D. (Kyung Hee Univ., Seoul, Korea, 1988); Jon Lomasney, M.D. (Dartmouth, 1987); N. A. Okonkwo, M.B., B.S., M.R.C.R. FCAnaes. (Newcastle, England, 1982); Richard Ooi, M.B., Ch.B., FCAnaes. (Bristol, England, 1984); Iain Sanderson, M.A., M.Sc., F.R.C.A. Anaes. (Oxford University, England, 1985); Masaharu Shiraishi, M.D.

(Juntendo Univ. School of Med., Tokyo, Japan, 1985); Matthew Wood, M.B., Ch.B., M.R.C.P., FCAes. (Manchester, England, 1984).

Scholar in Residence: Kenneth Sugioka, M.D. (Washington Univ., 1949).

Emeritus: Merel H. Harmel, M.D. (Johns Hopkins, 1943).

Electives

ANE 214C. Advanced Cardiac Life Support (ACLS). The ACLS course will follow the American Heart Association (AHA) guidelines: successful completion will certify the participation as an ACLS Provider. There will be seven one hour lectures, a four hour laboratory (practice session), and four hours of practical and written tests. Grading will be according to the AHA criteria. The course will be held on May 2 to 7, 1994. The lectures will be held for two hours on Monday and Tuesday and three hours on Wednesday. Thursday will have no lecture or lab. Depending on enrollment, labs (stations) will be held on Friday or Friday and Saturday. If less than fifty people register, the practice stations will be Friday morning and the testing stations will be Friday afternoon; if more than fifty people register, the groups will attend half day practice sessions on Friday and half day testing stations on Saturday. Prerequisite: Basic Life Support Certification. (CPR) Weight: 1 Min: 10 Max: 100. K. Phillips

ANE-240C. Clinical Anesthesiology. This course (four or eight weeks) is designed to directly expose students to the clinical practice of anesthesiology. Throughout the rotation, each student is assigned on a weekly basis to an individual resident or attending physician who will supervise the student's active participation in the pre-, intra-, and post-operative anesthetic care and management of patients. Opportunities exist for students to participate in the various subspecialty areas of anesthesiology including pediatric, obstetric, cardiac, and neurosurgical anesthesia as well as the recovery room, ICU, and pain clinic. While initial assignments will be made prior to the first day of the rotation, there is flexibility with regard to students' particular areas of interest. The evaluation of patients pre-operatively will be taught with emphasis placed upon formulating a plan of anesthetic management which is appropriate for the individual patient. The consequential impact of anesthetics and surgical procedures upon particular disease states will also be stressed. Students will review the clinical pharmacology of anesthetic and adjuvant drugs as well as apply the principles of pharmacology, physiology, and anatomy to the clinical anesthetic management of patients. Didactic information regarding principles of airway management including endotracheal intubation will be presented and reinforced with application in the clinical setting. Participants will be exposed to basic methods of administering anesthetics and monitoring the depth of anesthesia through physiologic responses of the patient. Instruction in the appropriate techniques and complications of obtaining vascular access for administering drugs and monitoring hemodynamic status will be provided. In addition to this clinical work, students will be given the opportunity to attend various lectures including an introductory series (covering preoperative assessment, airway management, and anesthesia equipment), grand rounds and resident lecture series, and various subspecialty conferences (cardiac, pediatrics). Weight: 4 or 8 Max: 8 for 4 week course, 2-4 may extend for an additional 4 weeks. Not Offered in July / August. T. Webb and staff

ANE-241C. SICU/Recovery. Four weeks may be spent in a SICU and Post Anesthesia Care Unit (PACU) participating in the care of a wide variety of patients with critical surgical illnesses. The students will participate in morning and afternoon rounds with SICU attendings and residents and will be offered lectures on aspects of critical care several times per week. They will also take call one night in four and have an excellent opportunity to work on a one-on-one basis with the anesthesiology resident in the direct management of acute anesthesia, post-anesthesia, and SICU problems. There is direct teaching of the principles of postoperative management after cardiac surgery, major vascular and thoracic surgery, as well as opportunities to learn procedures and techniques necessary for the management of all critically ill patients (e.g. vascular catheterization, hemodynamic monitoring, and mechanical ventilation). Weight: 5 Max: 4. Sladen and staff

ANE-242C. Anesthesiology Research. Selected students will participate actively in assigned research projects. These well-focused segments of ongoing work in the Department of Anesthesiology are designed to provide an intensive exposure to the process of new investigation in applied pharmacology and physiology. Most students are based in the Anesthesiology Research Laboratories and are strongly oriented toward personal involvement in the clinical research settings in the Duke Medical Center operating rooms, obstetrical delivery areas, post-operative and intensive care units, the Hyperbaric Laboratories, the pain clinic, or the Clinic Research Unit. An important goal of this experience consists of guiding the student to take conceptual information and to change it into concrete scientific presentation and publication. This course is designed primarily for the student who wishes to consider seriously a career in academic anesthesiology. Weight: 4-8 Max: 2. *P. Glass and staff*

Biochemistry

James B. Duke Professor Robert L. Hill, Ph.D. (Kansas, 1954), *Chairman*.

Professors: James B. Duke Professor Robert M. Bell, Ph.D. (California at Berkeley, 1970); G. Vann Bennett, M.D., Ph.D. (Johns Hopkins, 1976); James B. Duke Professor Irwin Fridovich, Ph.D. (Duke, 1955); Arno L. Greenleaf, Ph.D., (Harvard, 1974); Gordon G. Hammes, Ph.D. (Wisconsin, 1959); Norman Kirshner, Ph.D. (Pennsylvania State, 1952); Nicholas M. Kredich M.D. (Michigan, 1962); James B. Duke Professor Robert J. Lefkowitz, M.D. (Columbia, 1966); James B. Duke Professor Paul L. Modrich, Ph.D. (Stanford, 1973); K. V. Rajagopalan, Ph.D. (University of Madras, 1957); David C. Richardson, Ph.D. (Massachusetts Inst. of Tech., 1967); Jane S. Richardson, M.S., M.S.T. (Harvard, 1966); Lewis M. Siegel, Ph.D. (Johns Hopkins, 1965); Leonard D. Spicer, Ph.D. (Yale, 1968); Robert E. Webster, Ph.D. (Duke, 1965).

Associate Professors: Ronald C. Greene, Ph.D. (California Inst. of Tech., 1954); Tao-Shih Hsieh, Ph.D. (California at Berkeley, 1976); Bernard Kaufman, Ph.D. (Indiana, 1961); Harvey J. Sage, Ph.D. (Yale, 1958); Deborah A. Steege, Ph.D. (Yale, 1974); J. Bolling Sullivan, Ph.D. (Texas, 1966).

Assistant Professors: Michael D. Been, Ph.D. (Washington, 1982); Lorena S. Beese, Ph.D. (Brandeis, 1984); Perry J. Blackshear, M.D. (Harvard, 1977); Patrick Casey, Ph.D. (Brandeis, 1986); Carol A. Fierke, Ph.D. (Brandeis, 1984); Stephen Garrett, Ph.D. (Johns Hopkins, 1986); Homme W. Hellinga, Ph.D. (Cambridge, 1986); Michael S. Hershfield, M.D. (Pennsylvania, 1967); Russel E. Kaufman, M.D. (Ohio State, 1973); Terrence Oas, Ph.D. (Oregon, 1986); Keith L. Parker, M.D., Ph.D. (Washington, 1981); Sheldon R. Pinnell, M.D. (Yale, 1963); Salvatore V. Pizzo, M.D., Ph.D. (Duke, 1973); Gary L. Stiles, M.D. (Vanderbilt, 1975).

Assistant Research Professor: Jean L. Johnson, Ph.D. (Duke, 1974).

Adjunct Assistant Professor: Per-Otto Hagen, F.H.W.C. (Watt Univ., Scotland, 1961).

Research Associates: Neera Agrwal, Ph.D.; Dwayne Allen, Ph.D.; Roy A. Borchardt, Ph.D.; Eva M. Click, Ph.D.; Robert de Lorimer, Ph.D.; Allen E. Eckhardt, Ph.D.; Nobuko Hamaguchi, Ph.D.; David S. Harper, Ph.D.; Joan L. Hauser, Ph.D.; Jens M. Hemmingsen, Ph.D.; Barbara Hindenach, Ph.D.; Guewha S. Huang, Ph.D.; James Inglese, Ph.D.; Mahesh S. Joshi, Ph.D.; Thomas W. Kirby, Ph.D.; Ekaterini Kordeli, Ph.D.; Maxwell Lee, Ph.D.; Theodore W. Lee, Ph.D.; Guomin Li, Ph.D.; Stefan I. Liochev, Ph.D. Matthew Longley, Ph.D. David W. Myers, Ph.D.; Christopher Privalle, Ph.D.; Madaiah Puttaraju, Ph.D.; Andrew F. Quest, Ph.D.; Jian-Jun Shen, Ph.D.; Narasimha Swammy, Ph.D.; John D. Taylor, Ph.D.; Julia Thissen, Ph.D.; Ronald A. Venters, Ph.D.; Yang Wang, Ph.D.; Leroy Worth, Jr., Ph.D.; Fen Zhang, Ph.D.

Visiting Professor: Frederick P. Brooks, Jr., Ph.D. (Harvard).

Emeriti: Mary L. C. Bernheim, Ph.D.; Samson R. Gross, Ph.D.; Walter R. Guild, Ph.D.; Jerome S. Harris, M.D.; Kenneth S. McCarty, Sr., Ph.D.; Yashiko Nozaki, Ph.D.; Robert W. Wheat, Ph.D.

Required Courses

BCH-200. The core course given to all freshman medical students during a period of seven weeks in the first term emphasizes the relationship between structure and function of the major classes of macromolecules in living systems including proteins, carbohydrates, lipids, and nucleic acids. The metabolic interrelationships and control mechanisms are discussed as well as the biochemical basis of human diseases.

BCH-201. The required course in genetics for all first-year students is given during seven weeks in the first term. The course considers the fundamental processes of heredity from a biochemical viewpoint, together with a brief survey of classical genetics to provide context for the molecular phenomena. Its purpose is to provide an adequate background to allow the student to communicate with professional geneticists and to understand the new

molecular and cellular techniques for analysis of the human genome and evaluation of the genetic aspects of disease.

Electives

BCH-215B. Molecular Genetics I: Genetic Mechanisms. A study of genetic mechanisms in molecular terms with emphasis on gene function, segregation and regulation in prokaryotes and eukaryotes. The systems covered will include bacterial viruses, bacteria, plasmids, cellular organelles, and selected lower and higher eukaryotes. Course material will be drawn from the original literature and will be integrated as much as possible with Biochemistry 268B. C-L: Graduate School. Weight: 3. *Webster and staff*

BCH-259B. Molecular Biology I: Protein and Membrane Structure/Function. Detailed concepts of the structure and function of proteins as enzymes and as structural elements of cellular substructures including: protein primary structure and its determination, patterns of protein folding, mechanisms of enzyme catalysis, and other constituents of biological membranes. C-L: CBI 259B; MIC 259B; Graduate School. Weight: 3. *D. Richardson and staff*

BCH-268B. Molecular Biology II: Nucleic Acids. Biochemistry of nucleic acids, with emphasis on their chemistry, structure, metabolism, and biological function in information transfer. Prerequisites: introductory biochemistry and Biochemistry 259. C-L: IMM 268; MIC 268; Graduate School. Weight: 4. *Steege and staff*

BCH-288B. The Carbohydrates and Lipids of Biological Systems. The subjects will be considered in the following two general categories: 1. The relationship between structure and function particularly, (a) cell surface carbohydrates as antigenic determinants and their relationship to viral and carcinogen transformation, (b) connective tissue mucopolysaccharides, (c) structural features of lipids and phase transitions; 2. Biosyntheses and catabolism. C-L: Graduate School. Weight: 2 Min: 3 Max: 40. *Kaufman*

BCH-291B. Physical Biochemistry. Basic principles of physical chemistry as applied to biological systems. Course topics include thermodynamics, kinetics, statistical mechanics, spectroscopy and diffraction theory. All concepts are discussed in the context of the biochemistry and behavior of biological macromolecules. Emphasis is on a quantitative understanding of biochemical phenomena, with extensive problem solving as an instructive tool. Prerequisites: undergraduate physical chemistry and one year of calculus. C-L: Graduate School. Weight: 3. *Oas and staff*

BCH-320B. Cell Differentiation in Development and Disease. An introduction to the organization of the eukaryotic genome provided by recent technical advances in genetics and the use of recombinant DNA probes. Chromosome inactivation, gene amplification, and the impact of nucleocytoplasmic interactions on the regulation of differentiation will be considered. Transition phases of cell cycle will be discussed in regard to normal and oncogene function. Conferences will be devoted to specific examples dealing with critical aspects of differentiation involved in development of normal and disease states. The course is designed as an introduction to Hormone and Tissue Interactions in Differentiation and Disease. C-L: CBI 320B; Graduate School. Weight: 2 Max: 5. *K. McCarty Sr. and Counce*

BCH-321B. Hormone and Tissue Interactions in Differentiation and Disease. Hormones and other biochemical signals involved in the regulation of the differentiated state including amino acids, polypeptide, and steroid hormone response in insects, snails, and higher vertebrates will be discussed in terms of the new biotechnology used to elucidate mechanisms of information transfer and gene control at the level of the chromatin. Cell-cell, cell-matrix, and hormonal interactions will be considered as control elements in development and differentiation. Interactions involving the cell surface, the basal lamina, and extracellular matrix will be discussed in terms of differentiation of limb bud/pancreas/lymphocyte/ and

neural tissue. Conferences will include hormone control of sex differentiation, ectopic hormone biosynthesis, and endocrine related diseases. The course is designed as an extension of the course Differentiation in Development and Disease. C-L: CBI 321B; PTH 321B; Graduate School. Weight: 2 Max: 5. *K. McCarty Sr., B. Kaufman, and K. McCarty Jr.*

BCH-357B. Research in Biochemistry. In a limited number of cases, a student will be permitted to participate in the research program of a faculty member. Acceptance is by individual arrangement with the proposed faculty preceptor. Weight: 1-18. *Staff*

BCH-358B. Research in Biochemistry. A student may obtain first hand research experience by participating in the research program of a faculty member. Acceptance is by individual arrangement with the proposed faculty preceptor. Weight: 1-18. *Staff*

BCH-417B. Membranes, Receptors, and Cellular Signalling. Basic and current concepts of the biological membranes, membrane proteins and organization; mechanism of action of hormones at the cellular level including hormone-receptor interactions, secondary messenger systems for hormones, mechanism of regulation of hormone responsiveness, regulation of growth, differentiation and proliferation, cellular electrophysiological mechanisms of transport and ions channels, secretory and sensory stimulus sensing and transduction. Some lectures will stress the clinical correlation of the basic concepts in the course. C-L: CBI 417B; Graduate School. Weight: 3. *Webster, Caron, Bell, and invited lecturers*

Biological Anthropology and Anatomy

Professor: Richard F. Kay, Ph.D. (Yale, 1973), *Chairman.*

Professors: Matthew Cartmill, Ph.D. (Chicago, 1970); Kenneth Glander, Ph.D. (Chicago, 1975); William L. Hylander, D.D.S. (Illinois, 1963), Ph.D. (Chicago, 1972); James B. Duke Professor Elwyn L. Simons, Ph.D. (Princeton, 1956), D. Phil. (Oxford, 1959); John Terborgh, Ph.D. (Harvard, 1963).

Associate Professors: V. Louise Roth, Ph.D. (Yale, 1982); Kathleen K. Smith, Ph.D. (Harvard, 1980); Carel van Schaik, Ph.D. (Utrecht, 1985).

Assistant Professors: Frank H. Bassett III, M.D. (Louisville, 1957); Mary C. Maas, Ph.D. (New York at Stony Brook, 1988); Frances J. White, Ph.D. (New York at Stony Brook, 1986).

Adjunct Associate Professor: Patricia C. Wright, Ph.D. (City Univ. of New York, 1985).

Visiting Assistant Professors: Diane Doran, Ph.D. (New York at Stony Brook, 1989); Kathrine Manley-Buser, Ph.D., (California at Davis, 1991); David Watts, Ph.D. (Chicago, 1983).

Research Associates: Marianne Bouvier, Ph.D. (Duke, 1982); Michael E. Pereira, Ph.D. (Chicago, 1984); Matthew Ravosa, Ph.D. (Northwestern, 1989); Suzanne Strait, Ph.D. (New York at Stony Brook, 1991); Hans Thewissen, Ph.D. (Michigan, 1989).

Instructor: Kirk Johnson, M.A. (Duke, 1981).

Emeritus: Kenneth L. Duke, Ph.D. (Duke, 1940).

Required Course

First-year medical students are required to take Gross Anatomy (BAA-200). All instruction is designed to be informal and individualized.

BAA-200. Gross Human Anatomy. Includes complete dissection of a cadaver; laboratory work is supplemented by conferences which place emphasis upon biological and evolutionary aspects. 3 units. *Staff*

Electives

BAA-214B. Anatomy of the Head and Neck. This course is designed to be a review of the head and neck, emphasizing its phylogenetic and ontogenetic development along with clinically important features of the anatomy of this region. Weight: 2 Min: 5 Max: 12. *K. Smith and staff*

BAA-221B. Anatomy of the Trunk. Emphasis will be on the anatomy of the thoracic, abdominal, and pelvic organs including relationships, blood supply, and innervations and, where practical, developmental and microscopic anatomy. The dissections will be supple-

mented with audiovisual presentations and discussions with such prosections as are available. Weight: 2 Min: 8 Max: 20. *Cartmill and staff*

BAA-224B. Tutorial in Gross Anatomy. A detailed review of selected regions of the human body in the context of the "core" gross anatomy sequence. The student will plan prosections, special presentations, etc., with staff. The student will also elect to study one or more selected regions in consultation with staff. Weight: 1-5 Min: 1 Max: 5. *Hylander*

BAA-231B. Anatomy of Back and Extremities. Complete dissection of back and extremities including pectoral and pelvic girdles. Visual aids will be used extensively. Course planned for orthopaedics, general practice, or neurosurgery. Weight: 3 Min: 6 Max: 20. *Bassett and staff*

Cell Biology

George Barth Geller Professor for Research in Molecular Biology Michael P. Sheetz, Ph.D. (California Institute of Technology, 1972), *Chairman*.

Professor George M. Padilla, Ph.D. (California at Los Angeles, 1960), *Director of Medical Studies*.

Professors: Celia Bonaventura, Ph.D. (Texas at Austin, 1968); Joseph Bonaventura, Ph.D. (Texas at Austin, 1968); Marc G. Caron, Ph.D. (Miami, 1973); Sheila J. Counce, Ph.D. (Edinburgh, 1954); Harold P. Erickson, Ph.D. (Johns Hopkins, 1969); James B. Duke Professor Edward A. Johnson, M.D. (Sheffield, 1953); Thomas J. McIntosh, Ph.D. (Carnegie Mellon, 1973); R. Bruce Nicklas, Ph.D. (Columbia, 1958); Michael K. Reedy, M.D. (Washington, 1962).

Associate Professors: Joseph M. Corless, M.D., Ph.D. (Duke, 1972); Daniel P. Kiehart, Ph.D. (Pennsylvania, 1979); Frederick H. Schachat, Ph.D. (Stanford, 1974); David W. Schomberg, Ph.D. (Purdue, 1965).

Assistant Professors: Yair Argon, Ph.D. (Harvard, 1980); Thomas G. Chappell, Ph.D. (Stanford, 1986); Jonathan Cohn, M.D. (Rockefeller, 1978); Laura I. Davis, Ph.D. (Rockefeller, 1987); Arturo De Lozanne, Ph.D. (Stanford, 1988); William A. Dittman, Jr., M.D. (Washington, 1981); William E. Garrett, Jr., M.D., Ph.D. (Duke, 1976); Yusuf A. Hannun, M.D. (American University of Beirut, 1981); William E. Kraus, M.D. (Duke, 1982); Virginia Ann Lightner, M.D., Ph.D. (Duke, 1982); Tobias Meyer, Ph.D. (Basel, 1986); E. Timothy O'Brien, Ph.D. (California at Santa Barbara, 1986); Theresa O'Halloran, Ph.D. (North Carolina at Chapel Hill, 1986); Patricia M. Saling, Ph.D. (Pennsylvania, 1979); Katherine I. Swenson, Ph.D. (Washington, 1983); Margaret A. Titus, Ph.D. (Brandeis, 1987).

Associate Research Professor: Kenneth A. Taylor, Ph.D. (Berkeley, 1975).

Assistant Research Professors: Ling-Yi Chang, Ph.D. (North Carolina State, 1982); Thomas W. Gettys, Ph.D. (Clemson, 1984); J. Dirk Iglehart, M.D. (Harvard, 1975); David Miller III, Ph.D. (Rice, 1981); Rebecca J. Van Beneden, Ph.D. (Johns Hopkins, 1982); Glenn E. White, Ph.D. (Harvard, 1983).

Adjunct Professors: Vladimir Petrow, Ph.D., D.Sc. (London, 1947), F.R.S.C. (England, 1944); Martin Rodbell, Ph.D. (Washington, 1954).

Adjunct Associate Professor: J. Mailen Kootsey, Ph.D. (Brown, 1966).

Emeritus: R. J. Reynolds Professor in Medical Education Montrose J. Moses, Ph.D. (Columbia, 1949); Jacqueline A. Reynolds, Ph.D.; James B. Duke Professor J. David Robertson, M.D.

DIVISION OF PHYSIOLOGY

James B. Duke Professor J. Joseph Blum, Ph.D. (Chicago, 1954), *Head of Division*.

Professors: John W. Gutknecht, Ph.D. (North Carolina at Chapel Hill, 1963); Diane L. Hatchell, Ph.D. (Marquette, 1968); Frans F. Jöbsis, Ph.D. (Michigan, 1958); Melvyn Lieberman, Ph.D. (State Univ. of New York, 1964); Lazaro J. Mandel, Ph.D. (Pennsylvania, 1969); Thomas J. McManus, M.D. (Boston, 1955); Robert Plonsey, Ph.D. (California, 1956); George G. Somjen, M.D. (New Zealand, 1961); Joachim R. W. Sommer, M.D. (Munich, 1951); Madison S. Spach, M.D. (Duke, 1954); Ian L. Taylor, M.B., Ch.B., Ph.D. (Liverpool School of Medicine, 1976).

Associate Professors: Onyekwere E. Akwari, M.D. (Southern California, 1970); Nels C. Anderson, Ph.D. (Purdue, 1964); Peter B. Bennett, Ph.D., D. Sc. (Southampton, England, 1964); Frederick R. Cobb, M.D. (Mississippi, 1964); Joseph C. Greenfield, M.D. (Emory, 1956); Elliott Mills, Ph.D. (Columbia, 1964); Steven R. Vigna, Ph.D. (Washington, 1978).

Assistant Professors: Page A. W. Anderson, M.D. (Duke, 1963); Bruce A. Benjamin, Ph.D. (Oklahoma, 1980); Mark K. Drezner, M.D. (Pittsburgh, 1970); Michael Freemark, M.D. (Duke, 1976); Ann LeFurgey, Ph.D. (North Carolina at Chapel Hill, 1976); William E. Yarger, M.D. (Baylor, 1971).

Associate Research Professor: Peter G. Aitken, Ph.D. (Connecticut, 1978).

Assistant Research Professors: Bruce Maurice Klitzman, Ph.D. (Virginia, 1979); Bruce Lobaugh, Ph.D. (Pennsylvania State, 1981).

Adjunct Professor: John C. Parker, M.D. (Yale, 1961).

Adjunct Associate Professors: Charles R. Horres, Jr., Ph.D. (Duke, 1975); James M. Schooler, Jr., Ph.D. (Wisconsin, 1964).

Adjunct Assistant Professors: Reginald D. Carter, Ph.D. (Bowman Gray, 1970); Leslie A. Lobaugh, Ph.D. (Duke, 1986); Elizabeth Murphy, Ph.D. (Pennsylvania, 1980); R. Neal Shepherd, Ph.D. (Duke, 1975).

Emeritus: James B. Duke Professor Knut Schmidt-Nielsen, Dr. Phil. (Copenhagen, 1952).

Required Courses

CBI-200. Cell and Tissue Biology. Lectures on the structure and function of the cells and tissues of the body. The laboratory provides practical experience with light microscopy studying and analyzing the extensive slide collection of mammalian tissues. *McIntosh and staff*

CBI-201. Microscopic Anatomy. Lectures on the structural organization of the organs of the body, as determined by light and electron microscopy, with emphasis on the relation of structure to function at the cellular level. Laboratory sessions are used to study and analyze our extensive slide collection of mammalian tissues. *McIntosh and staff*

CBI 202. Medical Physiology. Lectures and conferences on cell and organ physiology. Human and medical aspects are stressed in clinical conferences. Lectures, conferences, and computer-based laboratory exercises. *N. Anderson and staff*

Electives

CBI-211B. Cellular Mechanisms of Injury. Selected topics in mechanisms of injury at the cellular and molecular levels chosen for reading and discussion in a combined lecture/seminar format. Subject matter varies each semester; can be taken more than once. Prerequisite: consent of instructor. C-L: Graduate School. Weight: 2 Min: 5 Max: 10. *LeFurgey, Mandel, and guest faculty*

CBI-212B. The Cell and Molecular Biology of Reproduction. During the last decade, cell, molecular, and neurobiological investigations have dramatically advanced our understanding of reproduction. In this course, we aim to focus on these recent findings to present an integrated view of the reproductive process in males and females. The general areas to be covered include neuroendocrinology, reproductive endocrinology, gametogenesis, and fertilization, although recent studies in areas such as gene regulation; intercellular communication; hormones, growth factors, and signalling; and early development and differentiation, will be emphasized. C-L: Graduate School. Weight: 3 Min: 6 Max: 20. *Saling and staff*

CBI-217B. Membrane Transport. Basic principles of the transport of water and solutes across biological and model membranes. The course uses physicochemical principles to achieve a comprehensive understanding of phenomena such as active and passive transport, energy barriers through membranes, surface effects, and ion selectivity. The methodology and conceptual framework for the study of transport is described with selected examples from bilayers, red blood cells, nerve and epithelia. Physical chemistry is recommended. Prerequisites: consent of instructor. C-L: Graduate School. Weight: 3 Min: 8. *Mandel and Simon*

CBI-219B. Preceptorship in Cell Biology/Physiology. Guided independent study of original literature and/or research experience in cell biology and/or physiology. Prerequisites: consent of instructor and departmental director of Medical Studies. Weight: 1-18. *Padilla*

CBI-220B. Topics in Biological Regulation. Current studies on regulatory mechanism of biological processes at the molecular, cellular, and organismal level of organization will form the basis of this seminar course. Lectures, individual student presentations, and group discussions of independent study projects and/or current research literature will be included. Major emphasis will be on the mechanisms of structural and functional integration

of biological activities of interest to the participants. Weight: 1 Min: 6 Max: 17. *Padilla, Vigna, and Benjamin*

CBI-222B. Respiratory System in Health and Disease. Primary emphasis is on the physiology of respiration. Topics covered include pulmonary mechanics, gas exchange, ventilation-perfusion relationships, central and peripheral regulation of ventilation and respiratory responses to exercise, altitude and hyperbaric environments. Weight: 2 Min: 4. *Jobsis*

CBI-237B. Analytical Imaging in Biomedical Research. Weekly seminars to discuss concepts and techniques in high resolution analytical imaging of cells and subcellular organelles and to review application of these concepts to structural-functional correlations in cell physiology and pathophysiology. C-L: Graduate School. Weight: 3 Min: 5 Max: 10. *LeFurgey, Ingram, and Kopf*

CBI-259B. Molecular Biology I: Protein and Membrane Structure/Function. Detailed concepts of the structure and function of proteins as enzymes and as structural elements of cellular substructures including: protein primary structure and its determination, patterns of protein folding, mechanisms of enzyme catalysis and regulation, function and formation of multimeric protein assemblies, proteins and other constituents of biological membranes. C-L: BCH 259B; MIC 259B; Graduate School. Weight: 3. *Erickson, D. Richardson, Bell, Hill, and J. Richardson*

CBI-269B. Advanced Cell Biology. Structural and functional organization of cells and their components with emphasis on current research problems and prospects. C-L: MIC 269B; Graduate School. Weight: 3. *Erickson, Nicklas, and staff*

CBI-320B. Cell Differentiation in Development and Disease. The primary objective is to present important concepts of organization and retrieval of genetic information as they relate to storage, replication, transcription, processing, and translation of genetic information. Chromosome inactivation, gene amplification, and the impact of nucleocytoplasmic interactions on the regulation of differentiation will be considered. Transition phases of cell cycle will be discussed in regard to normal and oncogene function. Conferences will be devoted to specific examples dealing with critical aspects of differentiation involved in development of normal and disease states. The course is designed as an introduction to Hormone and Tissue Interactions in Differentiation and Disease. C-L: BCH 320B. Weight: 2 Max: 5. *Counce and K. McCarty Sr.*

CBI-321B. Hormone and Tissue Interactions in Differentiation and Disease. Hormones and other biochemical signals involved in the regulation of the differentiated state including amino acids, polypeptide and steroid hormone response in insects, snails, and higher vertebrates will be discussed in terms of the new biotechnology used to elucidate mechanisms of information transfer and gene control at the level of the chromatin. Cell-cell, cell-matrix, and hormonal interactions will be considered as control elements in development and differentiation. Interactions involving the cell surface, the basal lamina, and extracellular matrix will be discussed in terms of organization of cell populations in gastrulation and neurulation and in the differentiation of limb bud/pancreas/lymphocyte/and neural tissue. Conferences will include hormone control of sex differentiation, ectopic hormone biosynthesis, and endocrine related diseases. The course is designed as an extension of the course Differentiation in Development and Disease. C-L: BCH 321B; PTH 321B. Weight: 2 Max: 5. *S. Counce, K. McCarty Sr., B. Kaufman, and K. McCarty Jr.*

CBI-340B. Tutorial in Cell Biology/Physiology. Selected topics will be chosen for intensive reading and discussion. Topics may be chosen relating to basic problems of cytology, growth and development, biophysics, endocrinological control, neuroanatomy, physiological differentiation, and evolutionary origins of functional microsystems. Prerequisites: permission of faculty preceptor. C-L: Graduate School. Weight: 1-3 Max: 8. *Staff*

CBI-414B. The Human Embryo. The first eight weeks of development are considered in detail including fertilization, implantation, formation and function of embryonic membranes and placenta, and establishment of major organ systems. Emphasis is placed on distinctive features of human embryogenesis and on causes, identification, and treatment of congenital defects. Weight: 2 Min: 5 Max: 12. *Counce, Crain, and Effmann*

CBI-417B. Membranes, Receptors, and Cellular Signalling. Basic and current concepts of biological membranes, membrane proteins and organization; mechanism of action of hormones at the cellular level including hormone-receptor interactions, secondary messenger systems for hormones, mechanisms of regulation of hormone responsiveness, regulation of growth, differentiation and proliferation, cellular electrophysiological mechanisms of transport and ion channels, secretory and sensory stimulus sensing and transduction. Some lectures will stress the clinical correlation of the basic concepts elaborated in the course. C-L: BCH 417B; Graduate School. Weight: 3 Max: 12. *Caron, Bell, and invited lecturers*

Cell Growth, Regulation, and Oncogenesis

James B. Duke Professor of Biochemistry: Robert M. Bell, Ph.D. (California at Berkeley, 1979), *Head of Section*.

Assistant Professors: Patrick J. Casey, Ph.D. (Brandeis, 1986); Mariano A. Garcia-Blanco, M.D. (Yale, 1984), Ph.D. (Yale, 1988); Stephen Garrett, Ph.D. (Johns Hopkins, 1986); Jonathan M. Horowitz, Ph.D. (Wisconsin, 1985); Katherine I. Swenson, Ph.D. (Washington, 1983).

Community and Family Medicine

DEPARTMENT OF COMMUNITY AND FAMILY MEDICINE

Professor George R. Parkerson, Jr., M.D. (Duke, 1953), M.P.H. (North Carolina at Chapel Hill, 1977), *Chairman*.

DIVISION OF BIOMETRY AND MEDICAL INFORMATICS

Associate Professor: William E. Wilkinson, Ph.D. (North Carolina at Chapel Hill, 1968), *Chief*.

Professors: Dan G. Blazer II, M.D. (Tennessee, 1969), Ph.D. (North Carolina at Chapel Hill, 1980); Thomas E. Frothingham, M.D. (Harvard, 1951); Stephen L. George, Ph.D. (Southern Methodist, 1969); William E. Hammond, Ph.D. (Duke, 1967).

Associate Professors: John R. Feussner, M.D. (Vermont, 1973); Frank E. Harrell, Jr., Ph.D. (North Carolina at Chapel Hill, 1979); Kerry L. Lee, Ph.D. (North Carolina at Chapel Hill, 1974).

Assistant Professors: Mark R. Conaway, Ph.D. (Minnesota, 1985); Deborah V. Dawson, Ph.D. (North Carolina at Chapel Hill, 1981); Elizabeth R. DeLong, Ph.D. (North Carolina at Chapel Hill, 1979); James E. Herndon II, Ph.D. (North Carolina at Chapel Hill, 1988); Bercedis L. Peterson, Ph.D. (North Carolina at Chapel Hill, 1986); Gina R. Petroni, Ph.D. (Michigan, 1990); Carl F. Pieper, Ph.D. (Columbia, 1990); Gary L. Rosner, Sc.D. (Harvard, 1985); Gregory P. Samsa, Ph.D. (North Carolina at Chapel Hill, 1988); Lloyd R. Smith, Ph.D. (Alabama at Birmingham, 1985); Darlene K. Stangl, Ph.D. (Carnegie Mellon, 1991).

Research Professor: Kenneth G. Manton, Ph.D. (Duke, 1974).

Assistant Research Professors: Joseph W. Hales, Ph.D. (Utah, 1991); Lawrence H. Muhlbaier, Ph.D. (North Carolina at Chapel Hill, 1981).

Research Associates: James D. Collins, Ph.D. (Duke, 1982); Roland Gettliffe, Ph.D. (Duke, 1989).

DIVISION OF RESEARCH AND EDUCATION

Assistant Professor: Walter E. Broadhead, M.D. (Duke, 1981), Ph.D. (North Carolina at Chapel Hill, 1987), *Chief*

Associate Professor: Barbara K. Rimer, Dr.P.H. (Johns Hopkins, 1981).

Associate: Wendy Denmark-Wahnefried, Ph.D. (Syracuse, 1988).

Clinical Associates: Deborah Bostock, M.D. (Bowman Gray, 1985); Lawrence Golusinski, M.D. (Med. Coll. of Virginia, 1989); Lenard Salzberg, M.D. (Albany, 1988).

Instructor: Flavio Marconi Monteiro, M.S. (Baylor, 1985).

FAMILY MEDICINE DIVISION

Assistant Professor: James L. Michener, M.D. (Harvard, 1978), *Chief*.

Professors: David M. Eddy, M.D. (Virginia, 1963), Ph.D. (Stanford, 1978); Clark C. Havighurst, J.D. (Northwestern, 1958); Siegfried H. Heyden, M.D. (Univ. of Berlin, Germany, 1951); Harmon L. Smith, Ph.D. (Duke, 1962).

Associate Professors: Barrie J. Hurwitz, M.B. (Witwatersrand Univ., 1968); Joseph Lipscomb, Jr., Ph.D. (North Carolina at Chapel Hill, 1975); Robert J. Sullivan, Jr., M.D. (Cornell, 1966), M.P.H. (North Carolina at Chapel Hill, 1973).

Assistant Professors: Toni M. Cutson, M.D. (Virginia, 1980); Linda S. Lee, Ph.D. (North Carolina at Chapel Hill, 1991); Jonathon L. Sheline, M.D. (North Carolina at Chapel Hill, 1984), M.P.H. (Harvard, 1978); Ruby L. Wilson, Ed.D. (Duke, 1968).

Associate: Catherine M. Severns, R.N.P. (Yale, 1971).

Assistant Clinical Professors: Kathryn A. Andolsek, M.D. (Northwestern, 1975); Melvin Berlin, M.D. (Duke, 1953); Kathryn Bucci, Pharm.D. (St. John's University, 1986); Joyce A. Copeland, M.D. (North Carolina at Chapel Hill, 1975); Clark R. Denniston, M.D. (Georgetown, 1983); Howard Eisonson, M.D. (Duke, 1979); Victoria K. Johnson, M.D. (California at Los Angeles, 1985); Mary Lee Lobach, M.D. (Vanderbilt, 1984); Albert A. Meyer, M.D. (New York at Brooklyn, 1975); Elizabeth Nadler, M.D. (New York Univ., 1985); Richard K. Serra, M.D. (Michigan, 1977); Barbara L. Sheline, M.D. (North Carolina at Chapel Hill, 1984), M.P.H. (North Carolina at Chapel Hill, 1984); Bret C. Williams, M.D. (Kansas, 1976), M.P.H. (North Carolina at Chapel Hill, 1988); Kimberly S. Yarnall, M.D. (Florida, 1985).

Clinical Associates: Anne W. Campbell, M.D. (Duke, 1978); William Gunn, Ph.D. (Virginia Polytechnic, 1986); Janet E. Lehr, M.D. (Florida, 1982); David Lobach, M.D. (Duke, 1987), Ph.D. (Duke, 1986); Loretta Sutphin, M.D. (Duke, 1986); Anne Walch, B.H.S. (Duke, 1985).

Clinical Instructor: Joseph W. Kertesz, Jr., M.A. (Michigan, 1973).

Research Associate: William T. Vaughan, R.Ph., R.P.A. (North Carolina at Chapel Hill, 1972).

DIVISION OF OCCUPATIONAL AND ENVIRONMENTAL MEDICINE

Associate Clinical Professor: George W. Jackson, M.D. (Case Western Reserve, 1968). *Chief.*

Professor: David G. Warren, J.D. (Duke, 1964).

Associate Clinical Professor: Jerry J. Tulis, Ph.D. (Catholic University of America, 1965).

Assistant Professors: Linda M. Frazier, M.D. (Mount Sinai, 1980), M.P.H. (North Carolina at Chapel Hill, 1992); Samuel D. Moon, M.D. (Virginia, 1975), M.P.H. (North Carolina at Chapel Hill, 1991).

Associate: Dennis Darcey, M.D. (North Carolina at Chapel Hill, 1986), M.S.P.H. (North Carolina at Chapel Hill, 1988).

Assistant Clinical Professors: David K. Broadwell, M.D. (Baylor, 1976), M.P.H. (Texas, 1986); Gary N. Greenberg, M.D. (Northwestern, 1978), M.P.H. (North Carolina at Chapel Hill, 1983); Ricky L. Langley, M.D. (Bowman Gray, 1983), M.P.H. (North Carolina at Chapel Hill, 1988); Craig R. Stenberg, Ph.D. (Denver, 1982); Woodhall Stopford, M.D. (Harvard, 1969), M.S.P.H. (North Carolina at Chapel Hill, 1980); Wayne R. Thomann, Dr.P.H. (North Carolina at Chapel Hill, 1983).

Assistant Consulting Professor: Anne M. Akwari, M.D. (Howard, 1976).

Clinical Associates: Carol E. Golin, M.D., (North Carolina at Chapel Hill, 1989); David P. Siebens, M.D. (Washington Univ., 1983); Andrew S. Silberman, M.S.W. (North Carolina at Chapel Hill, 1982).

Research Associate: James M. Schmidt, B.H.S. (Duke, 1974).

DIVISION OF PHYSICIAN ASSISTANT EDUCATION

Associate Clinical Professor: Reginald D. Carter, Ph.D. (Bowman Gray, 1970), *Chief.*

Assistant Clinical Professor: Joyce A. Copeland, M.D. (North Carolina at Chapel Hill, 1975), *Medical Director.*

Professor: Arthur C. Christakos, M.D. (South Carolina, 1955).

Assistant Professor: Malcolm Henderson Rourk, Jr., M.D. (Pennsylvania, 1963).

Assistant Clinical Professor: Patricia A. Dieter, M.P.A. (Pennsylvania State, 1983); Phillip Price, M.H.S. (Duke, 1991); Jan Victoria Scott, M.H.S. (Duke, 1991).

Clinical Associates: Lovest T. Alexander, M.H.S. (Duke, 1991); Mary Kay Austin, M.P.H. (North Carolina at Chapel Hill, 1985); Valerie Forbes, B.H.S. (Duke, 1987); Robert Giggey, PA-C (Maine Medical Center, 1991); Paul C. Hendrix, M.H.S. (Duke, 1991).

Instructor: Joyce Nichols, R.P.A. (Duke, 1970).

DUKE DIET AND FITNESS CENTER

Assistant Clinical Professor: Michael A. Hamilton, M.D. (Rochester, 1964), M.P.H. (North Carolina at Chapel Hill, 1969), *Chief.*

Assistant Clinical Professor: Ronette L. Kolotkin, Ph.D. (Minnesota, 1978).

ADJUNCT FACULTY

Adjunct Professors: Barbara S. Hulka, M.D. (Columbia, 1959), M.P.H. (Columbia, 1961), Chapel Hill, NC.

Adjunct Associate Professors: James F. Gifford, Jr., Ph.D. (Duke 1969), Durham, NC; Richard J. Levine, M.D. (St. Louis, 1971), Research Triangle Park, NC.

Adjunct Assistant Professors: James D. Bernstein, M.H.A. (Michigan, 1968), Raleigh, NC; Brian A. Boehlecke, M.D. (New York at Buffalo, 1970), M.P.H. (North Carolina at Chapel Hill, 1981), Chapel Hill,

NC; Clare J. Sanchez, M.D. (Colorado, 1975); Daniel A. Shugars, D.D.S. (Northwestern, 1975), Ph.D. (Northwestern, 1978); Bonnie Yankaskas, Ph.D. (North Carolina at Chapel Hill, 1982), M.P.H. (Yale, 1973).

COMMUNITY FACULTY

Associate Clinical Professor: Charles Ellenbogen, M.D. (Chicago-Pritzker, 1964), Fayetteville, NC.

Assistant Clinical Professors: Jessie A. Junker, M.D. (Med. Coll. of Wisconsin, 1984), Fayetteville, NC; James M. Wetter, M.D. (New York at Buffalo, 1974), Fayetteville, NC.

Clinical Associate: Oliver N. Oyama, Ph.D. (Indiana, 1985), Fayetteville, NC.

Consulting Professor: Barrie Cassileth, Ph.D. (Pennsylvania, 1978), Chapel Hill, NC; Donald M. Hayes, M.D. (Bowman Gray, 1954), Greensboro, NC.

Associate Consulting Professors: Joan Cornoni-Huntley, Ph.D. (North Carolina at Chapel Hill, 1970), Chapel Hill, NC; Sigrid J. Nelius, M.D. (Ludwig Maximilian, Germany, 1949), Durham, NC; Katharine M. Simon, Ph.D. (Iowa, 1979), St. Louis, MO; Samuel W. Warburton, Jr., M.D. (Pennsylvania, 1969).

Assistant Consulting Professors: Lawrence M. Alexander, M.D. (Duke, 1952), Sanford, NC; J. Powell Anderson, M.D. (Duke, 1949), Waynesboro, VA; William G. Aycock, M.D. (Duke, 1954), Mebane, NC; Evan A. Ballard, M.D. (Duke, 1976), Jonesville, NC; Daniel H. Barco, M.D. (Duke, 1972), Durham, NC; James E. Barham, M.D. (Duke, 1974), Durham, NC; William J. Blackley, M.D. (North Carolina at Chapel Hill, 1975), Elkin, NC; James S. Blair, Jr., M.D. (Maryland, 1947), Wallace, NC; Donald E. Bley, M.D. (Duke, 1972), Fredericksburg, VA; Don W. Bradley, M.D. (Med. Coll. of Virginia, 1976), Durham, NC; Susan E. Brown, M.D. (Georgetown, 1976), Durham, NC; Jack R. Cahn, M.D., (Pennsylvania State at Hershey, 1972), Sparta, NC; Jane T. Carswell, M.D. (Med. Coll. of Virginia, 1958), Lenoir, NC; Robert S. Cline, M.D., (North Carolina at Chapel Hill, 1957), Sanford, NC; Timothy D. Coughlin, M.D. (Cincinnati, 1972), Reno, NV; John W. Cromer, Jr., M.D. (Nebraska, 1972), M.S.P.H. (North Carolina at Chapel Hill, 1980), Wilmington, NC; Bruce A. Dalton, Jr., M.D. (North Carolina at Chapel Hill, 1969), Research Triangle Park, NC; Charles Davant III, M.D. (North Carolina at Chapel Hill, 1972), Blowing Rock, NC; John D. Davis, Jr., M.D. (North Carolina at Chapel Hill, 1978), Blowing Rock, NC; Clyde J. Dellinger, M.D. (Duke, 1961), Drexel, NC; Curtis J. Eshelman, M.D. (Michigan, 1971), Durham, NC; Lawrence L. Fleenor, Jr., M.D., (Virginia, 1966), Big Stone Gap, VA; Henry A. Fleishman, M.D. (Emory, 1974); John S. Gaskin, Jr., M.D. (Duke, 1959), Albemarle, NC; Raymond A. Gaskins, Jr., M.D. (North Carolina at Chapel Hill, 1975), Fayetteville, NC; Harry I. Geisberg, M.D. (Louisville, 1972), Anderson, SC; E. Albino Gomez-Uria, M.D. (Madrid School of Medicine, 1962), Asheville, NC; Wilson Griffin III, M.D. (Duke, 1977), Jonesville, NC; James K. Hartye, M.D. (Vanderbilt, 1977), North Wilkesboro, NC; Paul O. Howard, M.D. (Virginia, 1955), Sanford, NC; Peter Jacobi, M.D. (Western Reserve, 1979), Durham, NC; Lane E. Jennings, M.D. (Miami, 1975), Port Orange, FL; Pamela H. Jessup, M.D. (Bowman Gray, 1977), Sanford, NC; Eric M. Johnsen, M.D. (Wayne State, 1977), Albemarle, NC; Lyndon K. Jordan, M.D. (Duke, 1965), Smithfield, NC; Hervy B. Kornegay, Sr., M.D. (Bowman Gray, 1957), Mount Olive, NC; Charles W. Lapp, M.D. (Albany Med. Coll., 1974), Raleigh, NC; Walter L. Larimore, M.D. (Louisiana, 1977), Byron City, NC; Richard V. Liles, Jr., M.D. (North Carolina at Chapel Hill, 1957), Albemarle, NC; Rodney L. Lowman, Ph.D. (Michigan State, 1979), Bel Aire, TX; Mary E. Lyon, M.D. (Bowman Gray, 1977), Sparta, NC; Kathryn Magruder-Habib, Ph.D. (North Carolina at Chapel Hill, 1987), Washington, DC; Robert H. McConnell, Jr., M.D. (Indiana, 1972), Sanford, NC; G. Yancey Mebane, M.D. (Duke, 1954), Mebane, NC; Lawrence Myers, Ph.D. (California at Berkeley, 1972), Research Triangle Park, NC; James A. Oppold, Ph.D. (Florida, 1969), Raleigh, NC; George R. Parkerson III, M.D. (Duke, 1984), M.P.H. (Harvard, 1985), Boston, MA; Melvin T. Pinn, Jr., M.D. (Virginia, 1976), Charlotte, NC; Calvin Reams III, M.D. (Miami 1975), Thomasville, NC; Jessica Sax-Schorr, M.D. (Tufts, 1977), Charlotte, NC; Charles P. Scheil, M.D. (Duke, 1958), Lenoir, NC; Evelyn D. Schmidt, M.D. (Duke 1951), M.P.H. (Columbia, 1962), Durham, NC; Harold D. Schutte, M.D. (Loma Linda, 1962), Asheville, NC; Philip G. Singer, M.D. (Duke, 1975), Hillsborough, NC; Hal M. Stuart, M.D. (Bowman Gray, 1956), Elkin, NC; Richard L. Taylor, M.D. (North Carolina at Chapel Hill, 1962), Oxford, NC; Beverly W. Tucker, M.D., (North Carolina at Chapel Hill, 1966), Henderson, NC; George R. Tucker Jr., M.D. (North Carolina at Chapel Hill, 1955), Henderson, NC; Christopher Unger, M.D. (Pennsylvania, 1969), Bethesda, MD; William B. Waddell, M.D. (Duke, 1962), Galax, VA; John W. Watson, M.D. (Med. Coll. of Virginia, 1953), Oxford, NC; Abner C. Withers, M.D. (North Carolina at Chapel Hill, 1962), Morganton, NC; Glenn A. Withrow, M.D. (North Carolina at Chapel Hill, 1985), Durham, NC; Robert K. Yowell, M.D. (Duke, 1961), Durham, NC.

Consulting Associates: John B. Anderson, Jr., M.D. (Cincinnati, 1980), Oxford, NC; Gary O. Bean, M.D. (Bowman Gray, 1976), Raleigh, NC; Clarence H. Beavers, M.D. (West Virginia, 1982), Eden, NC; William H. Billica, M.D. (North Carolina at Chapel Hill, 1985), Phoenix, AZ; Mark G. Blumenthal, M.D. (Rutgers, 1987), M.P.H. (California, 1983); Kevin Broyles, M.D. (Florida, 1986), Chapel Hill, NC; Sarah Cornwell, M.D. (Duke, 1985), Durham, NC; Daniel D. Crummett, M.D. (Wayne State, 1982), Hillsborough, NC; Terry G. Daniel, M.D. (West Virginia, 1988) Eden, NC; Ann K. Freneau, M.D. (George Washington, 1985) Durham, NC; William E. Hall, M.D. (Abraham Lincoln, 1973), Sanford, NC; Christopher D. Hoffman, M.D. (Med. Coll. of Georgia, 1988); Craig Hoffmeier, M.D. (Louisiana State, 1986) Chapel Hill, NC; Kevin P. Howard, M.D. (Wayne State, 1982), Reidsville, NC; Diane C. Hudson, M.D. (Missouri, 1987) Newton Grove, NC; David C. Jones, M.D. (Duke, 1979), Mebane, NC; Thomas F. Koinis, M.D. (Case Western, 1980), Fayetteville, NC; Eugenie M. Komives, M.D. (Harvard, 1985) Durham, NC; Frank W. Leak, M.D. (North Carolina at Chapel Hill, 1967), Clinton, NC; Glen R. Liesegang, M.D. (Kentucky, 1983), Blowing Rock, NC; John R. Mangum, M.D. (North Carolina at Chapel Hill, 1981), Sanford, NC; James S. McGrath, M.D. (Tulane, 1980), Durham, NC; Jennie A. McLaurin, M.D. (Bowman Gray, 1985), Newton Grove, NC; L. David Nave, Jr., M.D. (Bowman Gray, 1981),

Sanford, NC; Susan C. Nelson, M.D. (Texas at Houston, 1985), Oxford, NC; J. T. Newton, M.D. (North Carolina at Chapel Hill, 1981), Clinton, NC; Sandra J. Newton, M.D. (Wayne State, 1984), Durham, NC; Malcom H. Pannrill, B.H.S. (Bowman Gray, 1988), Fayetteville, NC; Latham C. Peak, M.D. (Bowman Gray, 1951), Clinton, NC; Gwendolyn Powell, M.D. (Miami, 1981), M.P.H. (North Carolina at Chapel Hill, 1986), Durham, NC; Paul W. Sasser, M.D. (California at Los Angeles, 1984), Eden, NC; Roberta L. Scherr, M.D. (Hahnemann, 1987), Mt. Holly, NJ; Deborah Smith, M.S.W. (North Carolina at Chapel Hill, 1979), Durham, NC; Greg Stave, M.D. (Duke, 1984), J.D. (Duke, 1984), M.P.H. (North Carolina at Chapel Hill, 1989), Research Triangle Park, NC; Philip E. Stover, M.D. (Eastern Virginia, 1980), Louisburg, NC; Dennis O'G. Stuart, M.D. (Med. Coll. of Virginia, 1982), Elkin, NC; Jane Sutter, M.D. (California at San Francisco, 1983), Hillsborough, NC; Eugene Wade, M.D. (Howard, 1981), Burlington, NC; Jon V. Warkentin, M.D. (Indiana, 1988), Garner, NC; Scott E. Woods, M.D. (Cincinnati, 1987), Durham, NC.

Emeriti: E. Harvey Estes, Jr., M.D.; Dorothy E. Naumann, M.D.; Max Woodbury, Ph.D.

Required Course

CFM-205. Clerkship in Family Medicine. This basic course in family medicine consists of an eight-week clinical clerkship in the second year. The course's goal is to provide students with an understanding of the principles of family medicine and of how these principles apply in community practice. The course emphasizes continuous and comprehensive health care for people of both sexes and all ages within the context of their social groups and the communities. Particular attention is paid to the diagnosis and treatment of common medical problems and to health maintenance, ambulatory care, continuity of care and the role of consultants in primary care. Other topics covered include social factors, such as the doctor-patient relationship and the role of the physician in the community, and the economics of health care delivery.

The clerkship is divided into two parts. During the first half, students are placed with community-based faculty who are practicing family physicians in communities outside of Durham, principally within North Carolina. Many of these preceptorship sites are in rural communities, providing students with exposure to many issues of rural health care such as farming and other occupational injuries, transportation difficulties, and local customs. Students gain extensive experience in diagnosing and managing patient problems under the guidance of the department's faculty. In addition, the preceptorship provides students with opportunities to see patients in a variety of settings, including office, home, nursing home, and community hospital.

For the second half of the clerkship, students are based with full-time family medicine faculty on campus. In addition to continued primary care clinical experience, this segment provides intensive training in health maintenance and disease prevention. Students review the recommendations from the U. S. Preventive Services Task Force, and develop the skills necessary to provide patients with quality health maintenance care. The students learn counseling skills in nutrition, exercise, safe sex practices, and smoking and alcohol cessation. Didactic sessions cover screening tests and immunizations, along with the epidemiologic background for evaluating these practices. Students also visit various community sites which offer health maintenance.

The on-campus component provides considerably more structured instruction, while the off-campus preceptorship provides a more "real life" experience in the practice of medicine in the community. The two components supplement each other, and together offer the student a broad exposure to medical problems and a realistic perspective on medicine and its relation to other important institutions in the community. It also provides a basis for understanding the interdependent relationships between community and referral center physicians. Due to scheduling requirements, no drops will be permitted within 30 days of the first day of rotation.

CFM-207. Preceptorship in Family Medicine. This course is identical to the preceptorship component of CFM-205, described above. Each student has a choice of either CFM-205 or a combination of CFM-207 and MED-207, the four-week neurology clerkship. Due to scheduling requirements, no drops will be permitted within 30 days of the first day of rotation.

Electives

CFM-236B. Digital Computers and Their Application in Ambulatory Care. For students desiring an intensive exposure to medical computer application. The flexible format of the course permits a variety of projects in computer medicine. Examples include projects in medical data bases; interactive patient interviewing; computer-aided instruction; patient/MD education/data collections, organization, retrieval, display and analysis; and MD assist programs. Opportunities exist for activities at the Duke Family Medicine Center in Durham, Duke/FAHEC Family Medicine Center in Fayetteville and other sites. Prerequisite: permission of instructor. Weight: 1-8 Max: 5. *Hammond, Michener, and Blackwell*

CFM-238B. Tutorial in Community and Family Medicine. An eight week, individually arranged experience in which the student participates in the research program of a faculty member. The subject matter, course weight, and meeting time will be arranged with the faculty member. Each student will meet regularly with his faculty preceptor and will carry out a project related to the preceptor's work. Through these discussions and the project, the student will be able to develop an understanding of the discipline involved. Possible areas include health education, geriatrics, family dynamics, occupational health, health assessment, medical education, management sciences, economic aspects of health care, computer technology, biostatistics and epidemiology, clinical decision making, diagnosis and management of common problems, alcoholism and social support systems. Because of the variety of projects available and the necessity of prior arrangements, it is essential that interested students consult with instructor and staff at least two months before the beginning of the term selected. Prerequisite: permission of instructor. Weight: 1-18. *Parkerson and staff*

CFM-240B. Epidemiologic Methods in Primary Care Research. This is a survey course covering basic principles and methods of epidemiologic research and their application to primary care populations. Topics covered in this course include refining a research question, methods of reviewing the literature, ethical considerations in research involving human subjects, and the basic types of study design in epidemiology. Other concepts of design, analysis, and interpretation of data to be covered include errors in statistical inference, bias, confounding, interaction, and epidemiologic inference. Methods of questionnaire design and data collection will be studied as well as the logistics of study implementation and basic methods of data analysis. Course activities include lecture, directed readings, and discussions of research questions chosen by the students in consultation with the instructors. Students are required to prepare a detailed study proposal by the end of the term. Interested students should consult with the instructor at least two months before the beginning of the term. Prerequisite: permission of instructor. Weight: 2 Min: 2 Max: 5. *Broadhead and Yankaskas*

CFM-243B. Occupational Medicine. This course is designed to enhance the student's basic science skills in three important areas related to occupational medicine: clinical toxicology, industrial hygiene, and epidemiology. Students have the option of scheduling a four or eight week rotation. During this time, they will complete readings related to these three areas, participate in lectures and seminars, learn to conduct computerized database searches concerning industrial toxicology issues and cases, and visit industrial sites as part of the experience. Students will also be given at least one project which will involve evaluation of chemical exposures in the work environment and medical evaluation of suspected cases of occupational disease. Upon completion of the rotation, students can expect to have practical and useful skills in evaluating occupational exposures and making a reasonable risk assessment of those exposures. Weight: 6 Max: 2. *Stopford and Greenberg*

CFM-244B. Seminars in Occupational Medicine and Toxicology. A variety of topics will be presented which relate to occupational and environmental hazards important to North Carolina. Toxicologic hazards associated with agriculture, textiles, microelectronics, biotechnology, health care institutions, and other industries will be discussed. Students will

be given readings in preparation for the seminars. Duke faculty, outside faculty, and guest lecturers will participate in the seminar series. Weight: 2 Min: 3 Max: 6. *Stopford and faculty*

CFM-246B. Historical Studies in a Medical Specialty. This elective is offered primarily to those who have made the choice of their probable career specialty. It is intended to provide an appreciation of the developments in that specialty and thereby deepen an understanding of it. While the choice of elective topic will be made on an individual basis and depend on the interests of each student, emphasis generally will be placed on specific theoretical, practical, and organizational developments since the second half of the 19th century. The format comprises selected readings, tutorials, and a student project. Weight: 1-2. *English and Gifford*

CFM-247B. Medicine in America. The historical development of the medical profession in the United States with attention to such topics as the changing basis of authority for medical practice, the education of physicians, the impact of science and technology on health care, physician-patient relations, the organization of the profession as a whole and by specialty, the emergence of the hospital, the role of government in health care delivery and contemporary criticisms of the health care system. The history of the Duke University Medical Center provides a recapitulation of course themes. Additional units of credit may be earned through independent study. Weight: 1. *Gifford*

CFM-248B. The Development of and Perspectives on Modern Medicine. Comprised of lectures, discussion, and readings, this course outlines the general history of medicine with particular attention given to recent developments. The course will include such topics as the contributions of William Harvey, medical systems, aspects of clinical diagnosis, and the evolution of key concepts in modern medicine such as cell theory, the germ theory, antisepsis, and theories of immunity. Full use will be made of the excellent resources of the Trent Collections. Additional unit of credit may be earned through independent study. Weight: 1. *Gifford*

CFM-214C. Rural Health Elective. Through a seminar series and experiences working in a community-sponsored rural health clinic, students will begin to understand the forces that impact health and health care in rural North Carolina. The seminar series includes speakers and discussion on such topics as the economics of health care, health education, worker health, environmental health, cultural and ethical bias in health care and community action for health care workers. Students organize volunteer staffing for the Fremont clinic, and orient and teach other students. Students should have volunteered for the North Carolina Student Rural Health Coalition in either year one or year two. The grade for this year-long course will be posted at the end of the second term. One credit per term will be awarded. C-L: MED 214C. Weight: 2 Min: 1 Max: 10. *B. Sheline*

CFM-250C. Clinical Nutrition. This course will provide an overview and opportunity to develop skills in the assessment and management of common nutritional problems in primary care. Topics include nutritional assessment; nutrition during pregnancy and lactation, infancy and childhood, as well as senescence; nutritional management of chronic diseases (diabetes, obesity, cardiovascular disease); health promotion/disease prevention. If permitted by the instructor, this clinical science course can be audited. Weight: 1 Max: 8. *Staff*

CFM-254C. Community Medicine Elective. This elective combines patient care with study of community health issues and population-based approach to treatment. Students develop an intervention plan for a problem they perceive and that is perceived by the community. Student also practice study design and implementation via a quality assurance project. Weight: 3 Max: 1. *B. Sheline and staff*

CFM-255C. Health Promotion and Disease Prevention. This elective is an intensive clinical experience in health promotion and disease prevention. Students see patients in the Duke Family Medicine Center, and participate in a variety of activities designed to help them

provide excellent health maintenance care. Specific content areas addressed include counseling skills in nutrition, safe sex practices, and smoking and alcohol cessation, as well as screening tests and immunizations. Weight: 4 Min: 2 Max: 6. *Yarnall and staff*

CFM-256C. Ethical Issues in Medicine. This seminar will examine ethical questions raised by modern biomedical science and technology with special attention to their implications for primary care practitioners. It will offer both historical and systematic analysis and attend to models of physician-patient relationships. Among topics for consideration will be ethical method (resource allocation, justice, and public policy), medical beneficence, and concepts of rights together with selected practice-related issues (e.g., truth-telling, confidentiality, abortion, contraception, consent, definition and meaning of death, behavior modification). If permitted by the instructor, this clinical science course can be audited. Weight: 1 Min: 2 Max: 10. *H. Smith*

CFM-257C. Philosophic Problems for Physicians. This seminar is designed to help the fourth year medical student prepare for becoming an intern/resident in the areas of dealing with patients: taking on that level of responsibility, telling the family/patient about serious illness or about the patient's terminal condition, working with a family at the time of death, and dealing personally and professionally with the kinds of pressures placed on the intern/resident (how to do more than survive the next three to five years, keeping marriage together, being a parent, etc.) Prerequisite: permission of the instructor. If permitted by the instructor, this clinical science course can be audited. Weight: 2 or 4 Min: 3 Max: 8. *Puckett and staff*

CFM-258C. Legal Issues in Medicine. A seminar which introduces participants to the basic approach of law and legal process to contemporary issues in medical care including malpractice, hospital privileges, confidentiality, natural death, abortion, consent/authorization for treatment, human experimentation, and peer review. Topics may be chosen by individual students. Common misconceptions about malpractice law and the rights of physicians and patients as well as the legal mechanisms for resolving disputes will be examined including the role of expert witnesses. If permitted by the instructor, this clinical science course can be audited. Weight: 2 Min: 2 Max: 15. *Warren*

CFM-259C. Advanced Clerkship in Family Medicine. This course provides intensive instruction and practice in the care of primary care patients in the community setting. Students may select from two sites: the Duke Family Medicine Center on the Duke campus or the Duke-FAHEC Family Medicine Center in Fayetteville. This course has an outpatient focus and is recommended for students who would like to improve their skills in the care of ambulatory patients, especially those with common problems. Students will be involved with day to day patient care under the supervision of family physician faculty and residents. Because of restrictions on the number of students allowed at each site, students are advised to contact the Department as early as possible for course approval (at least eight weeks in advance). No drops will be permitted within 60 days of the first day of the rotation. Prerequisites: permission of instructor. Weight: 2-8 Max: 4. *Andolsek and staff*

CFM-260C. Subinternship in Family Medicine. This course provides senior medical students with an intense inpatient clinical rotation with responsibilities and autonomy similar to that of an intern. The student will act as the primary medical provider for inpatients on the Family Medicine service in Duke Hospital and follow outpatients at the Duke Family Medicine Center in the setting of a residency program. Clinical instruction and supervision on each patient encounter will be afforded by senior level housestaff and faculty members of the Department of Community and Family Medicine. Individual reading on patient problems encountered in the daily work routine is expected. Frequent balanced feedback will be provided to students. Students are advised to contact the Department as early as possible for course approval (at least eight weeks in advance). No drops will be permitted

within 60 days of the first day of the rotation. Prerequisites: permission of instructor. Weight: 4 Max: 1. *Nadler and staff*

CFM-261C. Family Medicine Continuity Experience. Students will manage a panel of patients over an extended period of time at the Duke Family Medicine Center under the supervision of family physician faculty and fellows. Patient care will be scheduled for one to two half days a week for two to four months. The rotation may be repeated to provide further continuity. A student project is also required. Due to the need for clinic schedule arrangements, students are advised to contact the department as soon as possible for course approval (at least eight weeks in advance). Prerequisites: permission of instructor. Weight: 2-8. *V. Johnson and staff*

CFM-262C. Clerkship in Occupational Medicine. This four to eight week clerkship is flexible and can offer experience in the areas of the design of occupational health programs, the management of occupational health services, and the care and evaluation of workers exposed to various chemical and physical agents. Seminars during the rotation can cover such topics as industrial toxicology, ergonomics, physiological stress in the work place, legal and ethical issues in occupational medicine and health promotion. Weight: 3-8 Max: 2. *Stopford and staff*

CFM-263C. Family and Psychological Aspects of Medicine. This course introduces students to the psychological and family aspects of primary care medicine. Students will learn concepts related to these factors, learn effective intervention strategies, and work with patients who reflect these issues. Videotaping of patient encounters will be involved. Weight: 2 Min: 1 Max: 2. *Kertesz*

CFM-267C. Metamorphosis through Diet and Exercise. The student will learn the team approach in the education and treatment of patients with weight management problems associated with dysfunctional lifestyle in settings where a variety of health professionals, including physicians, physician assistants, nurses, psychologists, nutritionists, and exercise physiologists are utilized. Direct observation, participation in clinical services, assigned readings, and tutorials are the teaching strategies used. Prerequisite: permission of instructor. Weight: 4-8 Max: 1. *Hamilton, Kolotkin, Alphin, and Keating*

CFM-271C. The Computer Textbook of Medicine. Students will participate in the ongoing development of a computerized database in cardiovascular disease. They will participate in research concerning the diagnosis, treatment, and prognosis of patients with coronary artery disease. And, they will learn how to make predictions about outcome based on test results of patients on the cardiology service. Prerequisite: permission of instructor. Weight: 2-4 Max: 5. *Pryor, Califf, Lee, and Harrell*

CFM-273C. The Ideal Physician. What is the role of the physician in relating with patients? How do you communicate with patients and families? How well do you do this? What is your "bedside manner"? How do you learn about this other than through models and self-reflection? This seminar will provide a small group atmosphere for learning more about such skills and for receiving direct feedback on your own communication style and skills. If allowed by instructor, this clinical science course can be audited. Prerequisite: permission of instructor. Weight: 1-2 Min: 3 Max: 8. *Puckett and staff*

CFM-274C. The Ideal Patient. Who is the "ideal" patient? What about those who are not so ideal? This seminar will combine theory and practice. Information about "difficult" personality types and effective interpersonal skills for dealing with these individuals will be integrated into actual practice. Members of the seminar will be asked to draw upon past and current experiences with difficult persons and situations as well as to focus on case presentations provided by the instructor. If permitted by the instructor, this clinical science course can be audited. Prerequisite: permission of instructor. Weight: 1-2 Min: 3 Max: 8. *Puckett and staff*

CFM-299C. Community and Family Medicine Preceptorship. An individually tailored preceptorship will be arranged for students to work with a family physician in a community practice site almost anywhere. The rotation will allow students to observe and participate in the delivery of health care to individual patients and their families within the context of the community in which they live. The rotation is intended to supplement and complement the second year core clerkship. A wide variety of geographic locations and practice types are available; students may choose from an extensive list or nominate a new site. Because of the necessity for prior arrangements with preceptors, it is essential that interested students contact the instructor as soon as possible and at least three months prior to the desired term. Drops will not be accepted. Prerequisites: permission of instructor. Weight: 4. *V. Johnson and staff*

DIVISION OF BIOMETRY AND MEDICAL INFORMATICS

BMI-211B. Probability and Statistical Inference. Laws of probability, probability distributions, descriptive statistics, graphical displays of relationships, philosophy of statistical tests, tests for differences in central tendency, paired comparisons, and correlation. Parametric and nonparametric procedures. Simple linear regression and one way analysis of variance. Type I and Type II errors and problems of multiple comparisons. Weight: 4. *W. E. Wilkinson*

BMI-212B. Design Of Etiological, Clinical, and Experimental Studies. General principles and issues of study design. Observational studies, including descriptive (correlational, case report, cross-sectional) studies, cohort and case-control designs, their relative advantages, and statistical methods used in their analysis. Classical designs (parallel group, randomized block, and cross-over) will be surveyed. Introduction to controlled clinical trials and to sequential design strategies. Ethical considerations will be discussed. Prerequisite: BMI 211B. Weight: 3. *Feussner*

BMI-213B. Research Data Management and Statistical Computing. Database management theory and techniques, including methods for the collection, entry, storage, and retrieval of research data. Statistical computing algorithms and techniques, primarily using SAS. Prerequisite: BMI 211B and experience with PC-DOS (e.g., Continuing Education short course) or permission of instructor. Weight: 3. *Pieper*

BMI-217B. Clinical Decision Analysis. Using formal methods for analyzing complex patient management problems. Structuring problems as trees. Applying data from the literature to estimate the likelihood of outcomes. Quantitating the value of health outcomes. Calculating the strength of preference for one strategy over others. Decision analysis as a guide to clinical research and as a policy tool. Prerequisite: BMI 211B or permission of instructor. Weight: 3. *Matchar*

BMI-233B. Biomedical Uses of Computers. An in-depth study of the use of computers in biomedical applications. Important concepts related to hardware, software, and applications development will be studied through analysis of state-of-the-art systems involving clinical decision support, computer-based interviewing, computer-based medical records, departmental/ancillary systems, instructional information systems, management systems, national data bases, physiological monitoring, and research systems. C-L: BME 243 (Graduate School). Weight: 3. *Hammond*

BMI-234B. Artificial Intelligence in Medicine. An introduction to basic concepts of Artificial Intelligence (AI) and an in-depth examination of medical applications of AI. The course includes heuristic programming, a brief examination of the classic AI programming languages (LISP and PROLOG) and a study of rule-based systems and cognitive models. Specific applications examined in detail include MYCIN, ONCOCIN, PIP, CASNET, and INTERNIST and selected EXPERT systems. C-L: BME 265 (Graduate School). Weight: 3. *Hammond*

BMI-235B. Microprocessors and Digital Instruments. Design of microcomputer-based devices including both hardware and software considerations of system design. Primary emphasis on hardware aspects including a progression through initial design, prototype construction in the laboratory, testing of prototypes to locate and correct faults, and final design evaluation. Evaluation includes examination of complexity, reliability, and cost. Design and construction is oriented toward biomedical devices or instruments that include dedicated microcomputers, usually operating in real time. C-L BME 205 (Graduate School). Weight: 3. *Hammond*

BMI-399B. Preceptorship in Biometry and Medical Informatics. An individualized research program under the direction and supervision of a member of the faculty of the Biometry and Medical Informatics Study Program. Weight: 1-18. *W. E. Wilkinson and staff*

Genetics

Professor: Joseph R. Nevins, Ph.D. (Duke, 1976), *Head of Section*.

Associate Professor: Bryan R. Cullen, Ph.D. (New Jersey Medical School, 1984).

Assistant Professors: Laura I. Davis, Ph.D. (Rockefeller, 1987); Joseph Heitman, M.D., Ph.D. (Cornell, 1992, Rockefeller, 1989); Robin P. Wharton, Ph.D. (Harvard, 1986).

Required Course

GEN-200. Fundamentals of Genetics. A course designed for first year medical students that focuses on the principles of genetics as they apply to human disease. The course emphasizes basic aspects of molecular genetics, experimental genetics and human genetics.

Immunology

Professor: Jeffrey Dawson, Ph.D. (Case Western Reserve, 1969); *Acting Chairman*.

Professors: James B. Duke Professor D. Bernard Amos, M.D. (Guy's Hospital, London, 1963); Robert C. Bast, Jr., M.D. (Harvard, 1971); Rebecca H. Buckley, M.D. (North Carolina at Chapel Hill, 1958); Barton F. Haynes, M.D. (Baylor, 1973); David R. McClay, Jr., Ph.D. (North Carolina at Chapel Hill, 1971); Richard S. Metzgar, Ph.D. (Buffalo, 1959); Wendell F. Rosse, M.D. (Chicago, 1958); Hillard F. Seigler, M.D. (North Carolina at Chapel Hill, 1960); Ralph Snyderman, M.D. (State Univ. of New York, 1965); Frances E. Ward, Ph.D. (Brown, 1965).

Associate Professors: Ralph R. Bollinger, M.D. (Tulane, 1970); Ronald B. Corley, Ph.D. (Duke, 1975); John D. Hamilton, M.D. (Colorado, 1964); Michael S. Krangel, Ph.D. (Harvard, 1982); Harvey J. Sage, Ph.D. (Yale, 1958).

Associate Research Professors: Andrew E. Balber, Ph.D. (Rockefeller, 1971); Kay H. Singer, Ph.D. (Duke, 1977).

Assistant Professors: Yair Argon, Ph.D. (Harvard, 1979); Charles E. Buckley III, M.D. (Duke, 1954); Carolyn Doyle, Ph.D. (New York at Stony Brook, 1985); Harry A. Gallis, M.D. (Duke, 1967); Russell P. Hall, M.D. (Missouri, 1975); Roger J. Kurlander, M.D. (Chicago, 1971); Mary Louise Markert, M.D. (Duke, 1982), Ph.D. (Duke, 1981); David S. Pisetsky, Ph.D. (Albert Einstein, 1972), M.D. (Albert Einstein, 1973); Jeffrey L. Platt, M.D. (Southern California, 1977).

Assistant Research Professor: Donna D. Kostyu, Ph.D. (Duke, 1979).

Research Associates: J. Burkhardt, Ph.D.; A. Colosia, Ph.D.; S. Doerre, Ph.D.; J. Dul, Ph.D.; C. Hernandez-Munain, Ph.D.; T. Hughey, Ph.D.; W. Koopmann, Ph.D.; P. Lauzurica, Ph.D.; G. McIntyre, Ph.D.; R. Misra, Ph.D.; R. Selvan, Ph.D.

Required Courses

IMM-201. A short core course in immunology for first-year medical students. The course includes a general introduction to special areas of immunology such as immunochemistry, immunohematology, and immunogenetics including transplantation and tumor immunology. The initial lectures describe the properties of antibodies, the characteristics of antigens, classes of reactive lymphocytes and accessory cells, the biology of substances released from lymphocytes (lymphokines) and the complement system. The course is enriched with clinical presentations and by discussion groups.

IMM-291. Comprehensive Immunology. An intensive course in the biology of the immune system and the structure and function of its component parts. Major topics discussed are: properties of antigens; specificity of antibody molecules and their biologic functions; cells

and organs of the lymphoid system; structure and function of complement; inflammation and non-specific effector mechanisms; cellular interactions and soluble mediators in lymphocyte activation, replication, and differentiation; regulation of immune responses, neoplasia and the immune system; molecular structure and genetic organization of immunoglobulins, histocompatibility antigens, and T cell receptor. C-L: Graduate School. Weight: 4. Max: 10. *Krangel and staff*

Electives

IMM-252B. General Virology and Viral Oncology. The first half of the course will be devoted to a discussion of the structure and replication of mammalian and bacterial viruses. The second half deals specifically with tumor viruses which are discussed in terms of the virus-cell interaction, the relationship of virus infection to neoplasia, and the application of retroviruses in molecular and developmental biology. Permission of the instructors is required. C-L: MIC 252B; Graduate School. Weight: 4 Min: 5. *Keene, Joklik, Bastia, Kreuzer, Ostrowski, Linney, Nevins, and Pickup*

IMM-259B. Molecular Biology I: Proteins and Enzymes. Detailed concepts of the structure and function of proteins as enzymes and as structural elements of cellular substructures including: protein primary structure and its determination, patterns of protein folding, mechanisms of enzyme catalysis and regulation, function and formation of multimeric protein assemblies, proteins and other constituents of biological membranes. C-L: BCH 259B; CBI 259B; MIC 259B; Graduate School. Weight: 3. *Richardson and staff*

IMM-268B. Molecular Biology II: Nucleic Acids. Biochemistry of nucleic acids, with emphasis on their chemistry, structure, metabolism, and biological function in information transfer. Prerequisites: introductory biochemistry and Biochemistry 259. C-L: BCH 268B; MIC 268B; Graduate School. Weight: 4. *Bastia, Been, Greenleaf, Hsieh, Johnston, Modrich, and Steege*

IMM-269B. Advanced Cell Biology. An advanced course in cell biology with emphasis on current research literature and featuring in-depth discussion of selected areas by staff engaged in research in these areas. The course covers membrane structure and physiology, the cytoskeleton, cell motility systems, chromosome mechanics, chromosome structure and function, and eukaryotic gene structure, control, and replication. C-L: CBI 269B; MIC 269B; Graduate School. Weight: 3. *Nicklas and staff*

IMM-291B. Comprehensive Immunology. An intensive course in the biology of the immune system and the structure and function of its component parts. Major topics discussed are: properties of antigens; specificity of antibody molecules and their biologic functions; cells and organs of the lymphoid system; structure and function of complement; inflammation and non-specific effector mechanisms; cellular interactions and soluble mediators in lymphocyte activation, replication, and differentiation; regulation of immune responses, neoplasia and the immune system; molecular structure and genetic organization of immunoglobulins, histocompatibility antigens, and T cell receptor. C-L: MIC 291B; Graduate School. Weight: 4; Max: 10. *Krangel and staff*

IMM-304B. Molecular Membrane Biology. Advanced seminar course on various cellular membranes; emphasis on cell biology of the immune system. Discussion topics include: biosynthesis of membrane proteins, intracellular transport vesicles, endocytosis, signal transduction across the plasma membrane, intracellular organelles and protein sorting, cell interactions in differentiation. Prerequisite: permission of instructor. C-L: MIC 304B; Graduate School. Weight: 2 Max: 16 Min: 10. *Argon*

IMM-330B. Medical Immunology. A brief review of basic concepts of immunology is followed by in-depth discussions of the role of immune mechanisms in the pathogenesis and treatment of human diseases. Principle emphasis is placed on immune deficiency diseases, hypersensitivity, alloimmunity, transplantation, infectious diseases, autoimmunity, tumor immunology, and immunohematology. When applicable the classes include patient presen-

tations and laboratory demonstrations. C-L: MIC 330B; Graduate School. Weight: 5. *F. Ward and staff*

IMM-335B. Current Topics in Immunology. This course focuses on current immunology research, emphasizing emerging research areas and new directions in established areas. The course provides a forum for students to present recent papers in selected subjects. 1 unit. *Corley and staff*

IMM-399B. Preceptorship in Immunology. An individual reading and/or laboratory course in specialty areas supervised by an individual faculty member. Acceptance, nature of topic, and amount of credit by individual arrangement with proposed faculty member. Prerequisites: to be determined by instructor. Weight: 1-18. *Staff*

Medicine

James B. Duke Professor Joseph C. Greenfield, Jr., M.D. (Emory, 1956), *Chairman*.

DIVISION OF ALLERGY, CRITICAL CARE, AND RESPIRATORY MEDICINE

Professor: James D. Crapo, M.D. (Rochester, 1971), *Chief*.

Professors: C. Edward Buckley, M.D. (Duke, 1954); Harold R. Rotman, M.D. (Univ. of Toronto, 1958); Herbert A. Saltzman, M.D. (Jefferson, 1952); Stephen L. Young, M.D. (California at San Francisco, 1968).

Research Professors: Melvin E. Anderson, Ph.D. (Cornell, 1971); Fredrick J. Miller, Ph.D. (North Carolina State, 1977).

Visiting Professor of Medicine: Werner Hofmann, Ph.D. (University of Vienna, 1973).

Associate Professors: William J. Fulkerson, M.D. (North Carolina at Chapel Hill, 1977); Neil R. MacIntyre, M.D. (Cornell, 1972); Claude Piantadosi, M.D. (Johns Hopkins, 1975).

Associate Research Professor: Robert R. Mercer, Ph.D. (North Carolina at Chapel Hill, 1982).

Assistant Professors: Phillip J. Fracica, M.D. (New York, Downstate, 1981); Andrew J. Ghio, M.D. (Boston Univ., 1981); Douglas G. Kelling, M.D. (Harvard, 1972); Peter S. Kussin, M.D. (Mount Sinai, 1985); Wayne M. Samuelson, M.D. (Utah, 1980); Mark P. Steele, M.D. (Illinois, 1982); Victor F. Tapson, M.D. (Hahnemann, 1982).

Assistant Research Professors: Barbara Buckley, Ph.D. (Johns Hopkins, 1985); Ling-Yi Chang, Ph.D. (North Carolina State, 1982); Anjilvel Satish, Ph.D. (New York Univ., 1984).

Associates in Medicine: Y. C. Tony Huang, M.D. (National Taiwan, 1983); Joseph A. Lasky, M.D. (Minnesota, 1985); Michael L. Russell, M.D. (North Carolina at Chapel Hill, 1985).

DIVISION OF CARDIOLOGY

Professor: Gary L. Stiles, M.D. (Vanderbilt, 1975), *Chief*.

Professors: Thomas M. Bashore, M.D. (Ohio, 1972); Victor S. Behar, M.D. (Duke, 1961); Fred R. Cobb, M.D. (Mississippi, 1964); Walter L. Floyd, M.D. (Johns Hopkins, 1954); James B. Duke Professor Joseph C. Greenfield, Jr., M.D. (Emory, 1956); Joseph R. Kisslo, M.D. (Hahnemann, 1967); Yi-Hong Kong, M.D. (Natl. Defense Med. Ctr., Taiwan, 1958); James B. Duke Professor Robert J. Lefkowitz, M.D. (Columbia, 1966); James J. Morris, M.D. (State Univ. of New York, 1959); Robert H. Peter, M.D. (Duke, 1961); Edward S. Orgain Professor of Medicine Harold C. Strauss, M.D. (McGill, 1964); Robert E. Whalen, M.D. (Cornell, 1956).

Associate Professors: Robert M. Califf, M.D. (Duke, 1978); Augustus O. Grant, M.D. (Edinburgh, 1971); Harry R. Phillips, M.D. (Duke, 1975); David B. Pryor, M.D. (Michigan, 1976); Robert A. Rosati, M.D. (Duke, 1967); Richard S. Stack, M.D. (Wayne State, 1976); Galen S. Wagner, M.D. (Duke, 1965); Robert Waugh, M.D. (Pennsylvania, 1966).

Associate Research Professors: Judith C. Rembert, Ph.D. (North Carolina at Chapel Hill, 1972); William M. Smith, Ph.D. (Duke, 1970).

Assistant Professors: Robert P. Bauman, M.D. (Wayne State, 1977); Stephen M. Denning, M.D. (Duke, 1980); Samuel E. George, M.D. (Washington Univ., 1980); J. Kevin Harrison, M.D. (New York Univ., 1984); Michael B. Higginbotham, M.D. (Univ. of Melbourne, 1973); L. Allen Kindman, M.D. (Mount Sinai, 1983); William E. Kraus, M.D. (Duke, 1982); Mitchell W. Krucoff, M.D. (George Washington, 1980); Daniel B. Marks, M.D. (Tufts, 1978); Christopher M. O'Conner, M.D. (Maryland, 1983); Jose A. Perez, M.D. (Southwestern, 1982); David C. Sane, M.D. (Duke, 1983); Michael H. Sketch, M.D. (Creighton, 1984); Martin J. Sullivan, M.D. (Ohio State, 1980); James Tchong, M.D. (Johns Hopkins, 1988); J. Marcus Wharton, M.D. (Vanderbilt, 1980).

Assistant Research Professors: Jack T. Cusma, Ph.D. (Wisconsin, 1983); Mark E. Olah, Ph.D. (Ohio, 1988); Zenghua Su, Ph.D. (The Second Med. Coll., 1970); Yuri Zilberter, Ph.D. (Moscow Univ., 1983).

Associates: Polly A. Beere, M.D. (Chicago, 1986); Stephen C. Culp, M.D. (Vermont, 1986); Julie K. Feters, M.D. (Ohio, 1986); Donald F. Fortin, M.D. (Massachusetts, 1984); David J. Frid, M.D. (Maryland, 1980); Christopher B. Granger, M.D. (Connecticut, 1984); Ruth Ann Greenfield, M.D.

(Duke, 1985); Sheila Kim Heinle, M.D. (Pittsburgh, 1986); Mames G. Jollis, M.D. (Ohio, 1986); E. Magnus Ohman, M.D. (Royal Coll. of Surgeons, 1981); Robert A. Sorrentino, M.D. (Albany Med. Coll. 1985); David J. Wendt, M.D. (Wayne State, 1982); James P. Zidar, M.D. (Loyola, 1985).

Visiting Associate in Medicine: Raye L. Bellinger, M.D. (Southwestern, 1982).

DIVISION OF CLINICAL PHARMACOLOGY

Professor: Edward L. C. Pritchett, M.D. (Ohio, 1971), *Chief*.

DIVISION OF DERMATOLOGY

J. Lamar Callaway Professor of Dermatology Sheldon R. Pinnell, M.D. (Yale, 1963), *Chief*.

Associate Professors: Russell P. Hall, M.D. (Missouri, 1975); Elise A. Olsen, M.D. (Baylor, 1978).

Assistant Professors: Claude S. Burton, M.D. (Duke, 1979); Robert E. Clark, M.D. (Texas, 1985); Virginia A. Lightner, M.D. (Duke, 1982); John C. Murray, M.D. (Duke, 1977); Neil S. Prose, M.D. (New York Univ., 1975); M. Joyce Rico, M.D. (Florida, 1981).

Assistant Research Professor: Heather N. Yeowell, Ph.D. (North Carolina at Chapel Hill, 1982).

Douglas J. Darr, Ph.D. (Pennsylvania State, 1982); Saood Murad, Ph.D. (California at Davis, 1978).

DIVISION OF ENDOCRINOLOGY, METABOLISM, AND NUTRITION

Professor Marc K. Drezner, M.D. (Pittsburgh, 1970), *Chief*.

Professor: Perry J. Blakeshear, M.D. (Harvard, 1977).

Associate Professors: Warner M. Burch, M.D. (Bowman Gray, 1971); Richard V. Clark, M.D. (Washington, 1977); George J. Ellis, M.D. (Harvard, 1963); Mark N. Feinglos, M.D. (McGill, 1973); Jerome M. Feldman, M.D. (Northwestern, 1961); John R. Guyton, M.D. (Harvard, 1973); Charles Johnson, M.D. (Howard, 1963); Keith Parker, M.D. (Washington Univ., 1981).

Assistant Professors: Michael J. Econs, M.D. (California at San Francisco, 1983); Rochelle M. Hanley, M.D. (Michigan, 1978); Kristine D. Harper, M.D. (Michigan State, 1980); Diana B. McNeill, M.D. (Duke, 1982).

Assistant Research Professors: Bruce Lobaugh, Ph.D. (Pennsylvania State, 1981); Deborah J. Stumpo, Ph.D. (West Virginia, 1984).

Associates: Leslie J. Domalik, M.D. (Pittsburgh, 1986); Ilene D. Weintraub, M.D. (Pittsburgh, 1987).

DIVISION OF GASTROENTEROLOGY

Professor: Ian L. Taylor, M.B. (Liverpool School of Medicine, 1969), *Chief*.

Professors: Peter B. Cotton, M.B. (St. Thomas Hosp., 1963); Michael McLeod, M.D. (Duke, 1960).

Associate Professors: J. Gregory Fitz, M.D. (Duke, 1979); John T. Garbutt, M.D. (Temple, 1962); Paul G. Killenberg, M.D. (Pennsylvania, 1963); Rodger A. Liddle, M.D. (Vanderbilt, 1978); Thomas T. Long, M.D. (Bowman Gray, 1966); Steven H. Quarfordt, M.D. (New York Univ., 1960); Joanne A. P. Wilson, M.D. (Duke, 1973).

Assistant Professors: John Affronti, M.D. (George Washington, 1985); John Baillie, M.B. (Glasgow Univ., 1977); M. Stanley Branch, M.D. (Med. Coll. of Georgia, 1984); Scott R. Brazer, M.D. (Case Western Reserve, 1981); Jonathan A. Cohn, M.D. (Rockefeller, 1978); Christine M. Hunt, M.D. (Boston Univ., 1982); Paul S. Jowell, M.D. (Univ. of Capetown, 1983); Peter J. Mannon, M.D. (Boston Univ., 1983); Toan D. Nguyen, M.D. (Chicago-Pritzker, 1978); Dawn Provenzale, M.D. (Albany, 1984).

Assistant Research Professors: Sheila Collins, Ph.D. (M.I.T., 1985); Thomas W. Gettys, Ph.D. (Clemson, 1984).

Associates: Paul D. Edwards, M.D. (Univ. of Sydney, 1981); Steven A. Guarisco, M.D. (Louisiana, 1986); Joseph W.-C. Leung, M.D. (Univ. of Hong Kong, 1975); James M. McGill, M.D. (Ohio, 1986); Nicholas D. Snow, M.D. (Ohio, 1985).

DIVISION OF GENERAL INTERNAL MEDICINE

Associate Professor: John R. Feussner, M.D. (Vermont, 1973), *Chief*.

Associate Professor: Francis A. Neelon, M.D. (Harvard, 1962).

Associate Research Professor: Morris Weinberger, Ph.D. (Purdue, 1978).

Assistant Professors: Charles O. Beauchamp, M.D. (Duke, 1975); M. Sue Kirkman, M.D. (North Carolina at Chapel Hill, 1982); David B. Matchar, M.D. (Maryland, 1980); Eugene Z. Oddone, M.D. (Colorado, 1985); Harry W. Severance, M.D. (Duke, 1981); David L. Simel, M.D. (Duke, 1980); Jeffrey G. Wong, M.D. (Utah, 1985).

Assistant Research Professors: Ronnie D. Horner, Ph.D. (Ohio State, 1984); Denise Hynes, Ph.D. (North Carolina at Chapel Hill, 1991).

Associates: Lori A. Bastian, M.D. (Emory, 1987); Dean D. Blakeley, M.D. (Missouri, 1988); John M. Brown, M.D. (Florida, 1984); Stephen P. Caminiti, M.D. (New York Univ., 1986); John J. Dallara, M.D. (Med. Coll. of Virginia, 1987); Lisa A. Giannetto, M.D. (Loyola, 1986); Joseph A. Govert, M.D. (California at Irvine, 1989); Sharon C. Hathaway, M.D. (Duke, 1987); William R. Hathaway, M.D. (Med. Coll. of Wisconsin, 1988); Faith H. Holcombe, M.D. (Washington Univ.,

1980); D. Andrew Knapp, M.D. (California at San Diego, 1984); Lee Wan Liu, M.D. (Maryland, 1984); Douglas C. McCrory, M.D. (Miami, 1986); John L. Morris, M.D. (Ohio State, 1986); John J. Paat, M.D. (Med. Coll. of Ohio, 1984); Bernadette R. Page, M.D. (Loyola, 1970); Paul J. Saba, M.D. (McGill, 1980); Robert W. Paterson, M.D. (Duke, 1979); W. Mark Stanton, M.D. (Mississippi, 1982); Jeannette F. Stein, M.D. (North Carolina at Chapel Hill, 1981); Eric C. Westman, M.D. (Wisconsin, 1986); Joseph E. Williamson, M.D. (North Carolina at Chapel Hill, 1973); K. Michael Zabel, M.D. (Washington Univ., 1988).

DIVISION OF GERIATRICS

Professor: Harvey Jay Cohen, M.D. (SUNY, 1965), *Chief*.

Associate Professor: Kenneth W. Lyles, M.D. (Med. Coll. of Virginia, 1974).

Assistant Professors: Anthony N. Galanos, M.D. (South Alabama, 1986); Gary G. Kochersberger, M.D. (Sackler, 1982); S. Spence McCachren, M.D. (Duke, 1978); Lina-Marie Obeid, M.D. (Beirut, 1983); Kenneth E. Schmader, M.D. (Bowman Gray, 1980).

Assistant Research Professors: Connie Bales, Ph.D. (Tennessee, 1981); Lucille A. Bearon, Ph.D. (Duke, 1982); Elizabeth Clipp, Ph.D. (Cornell, 1984); Melody Hobbins, M.D. (Kentucky, 1982); K. Murali Krishna Rao, Ph.D. (Gandhi Med. Coll., 1968).

Associates: Andrea Hackel, M.D. (Duke, 1981); Paul L. Mulhausen, M.D. (Minnesota, 1987); Debra K. Weiner, M.D. (Missouri, 1983).

DIVISION OF HEMATOLOGY-ONCOLOGY

Associate Professor: Russel Kaufman, M.D. (Ohio, 1973), *Chief*.

Professor: Welcome Clinical Professor in Honor of R. Wayne Rundles, M.D. Robert C. Bast, M.D. (Harvard, 1971), *Director, Comprehensive Cancer Center*.

Professors: Andrew T. Huang, M.D. (Taiwan, 1965); Florence McAllister Professor Wendell F. Rosse, M.D. (Chicago, 1958); Harold R. Silberman, M.D. (Washington Univ., 1956); J. Brice Weinberg, M.D. (Arkansas, 1969).

Associate Professors: Thomas D. Brown, M.D. (Med. Coll. of Virginia, 1979); Jon P. Gockerman, M.D. (Chicago, 1967); Charles S. Greenberg, M.D. (Hahnemann, 1976); Yusuf A. Hannun, M.D. (American University of Beirut, 1981); Roger J. Kurlander, M.D. (Chicago, 1971); Joseph O. Moore, M.D. (Johns Hopkins, 1971); Thomas F. Newcomb, M.D. (Pittsburgh, 1951); William B. Peters, M.D. (Columbia, 1978); Marilyn J. Telen, M.D. (New York, 1977).

Assistant Professors: Camille L. Bedrosian, M.D. (Harvard, 1983); Charles L. Bennett, M.D. (Pennsylvania, 1981); William Dittman, M.D. (Washington, 1981); Robert L. Fine, M.D. (Chicago, 1979); James W. Hathorn, M.D. (Duke, 1979); Kathleen A. Havlin, M.D. (Northwestern, 1982); Atif M. Hussein, M.D. (Beirut, 1982); William H. Kane, M.D. (Washington Univ., 1982); B. Gail Macik, M.D. (Texas at San Antonio, 1983); Barry R. Meisenberg, M.D. (Albany, 1982); George Phillips, M.D. (Duke, 1978); Maureen Ross, M.D. (Miami, 1984); James J. Vredenburg, M.D. (Vermont, 1983); Eric P. Winer, M.D. (Yale, 1983).

Associate Research Professor: Sandra L. White, Ph.D. (Michigan, 1974).

Assistant Research Professors: Komandoor E. Achyuthan, Ph.D. (Osmania, 1982); Cinda M. Boyer, Ph.D. (Pennsylvania, 1980); Donald E. Fleenor, Ph.D. (Emory, 1987); Feng Ji Xu, Ph.D. (Peking Union, 1970).

Associates: Mary E. Albers, M.D. (Indiana, 1986); Gerold Bepler, M.D. (Philipps Univ., 1983); Larry D. Cripe, M.D. (Rush, 1984); Raymund S. Cuevo, M.D. (Yale, 1986); Carlos de Castro, M.D. (Southwestern, 1985); Thomas L. Ortel, M.D. (Indiana, 1985); Manuel A. Santiago, M.D. (Puerto Rico, 1986); Robert A. Wolff, M.D. (Albany, 1986).

DIVISION OF INFECTIOUS DISEASES

Professor: David T. Durack, M.B., B.S. (West Australia, 1969); D.Phil. (Oxford, 1973), *Chief*.

Professor: John D. Hamilton, M.D. (Colorado, 1964).

Associate Professors: Harry A. Gallis, M.D. (Duke, 1967); Donald L. Granger, M.D. (Utah, 1972); John Perfect, M.D. (Med. Coll. of Ohio, 1975); Daniel J. Sexton, M.D. (Northwestern, 1971); Kenneth H. Wilson, M.D. (North Carolina at Chapel Hill, 1974).

Assistant Professors: June Almenoff, M.D. (Mt. Sinai, 1985); John A. Bartlett, M.D. (Virginia, 1981); J. Peter Ceglelski, M.D. (California at San Diego, 1984); G. Ralph Corey, M.D. (Baylor, 1973); Gunther J. Lallinger, M.D. (Ludwig, 1972); Hetty A. Waskin, M.D. (Michigan, 1978).

Assistant Research Professor: Dena L. Toffaletti, Ph.D. (North Carolina at Chapel Hill, 1977).

Associates: Miriam L. Cameron, M.D. (Bowman Gray, 1984); Carol S. Dukes, M.D. (Utah, 1985); Alison E. Heald, M.D. (Yale, 1989); Jerome H. Kim, M.D. (Yale, 1984).

DIVISION OF NEPHROLOGY

Professor: William E. Yarger, M.D. (Baylor, 1963), *Chief*.

Professors: James R. Clapp, M.D. (North Carolina at Chapel Hill, 1957); J. Caulie Gunnells, M.D. (South Carolina Med. Coll., 1956).

Associate Professor: Steve J. Schwab, M.D. (Missouri, 1979).

Assistant Professors: Thomas Coffman, M.D. (Ohio, 1980); John P. Middleton, M.D. (Med. Coll. of Virginia, 1983); L. Darryl Quarles, M.D. (Alabama, 1979); John R. Raymond, M.D. (Ohio State, 1982); Robert F. Spurney, M.D. (Ohio, 1983); Laura P. Svetkey, M.D. (Harvard, 1979).

Associates in Medicine: Frank J. Albers, M.D. (Cincinnati, 1984); David W. Butterly, M.D. (Duke, 1987); Roslyn B. Mannon, M.D. (Duke, 1985); Stephen R. Smith, M.D. (Duke, 1985); Daniel A. Yohay, M.D. (Duke, 1987).

DIVISION OF NEUROLOGY

Jefferson-Pilot Corporation Professor of Neurobiology Allen D. Roses, M.D. (Pennsylvania, 1967), *Chief*.

Professors: E. Wayne Massey, M.D. (Texas at Galveston, 1970); James O. McNamara, M.D. (Michigan, 1968); Donald B. Sanders, M.D. (Harvard, 1964).

Associate Professors: Barrie H. Hurwitz, M.D. (Witwatersrand Univ., 1968); Janice M. Massey, M.D. (Georgetown, 1978); Donald Schmechel, M.D. (Harvard, 1974); Ara Tourian, M.D. (Iowa, 1958).

Assistant Professors: Mark J. Alberts, M.D. (Tufts, 1982); Mark T. Brown, M.D. (Illinois, 1984); Nancy L. Earl, M.D. (North Carolina at Chapel Hill, 1982); Larry B. Goldstein, M.D. (Mt. Sinai, 1981); David A. Hosford, M.D. (Emory, 1983); Rodney A. Radtke, M.D. (Northwestern, 1980); Marvin Rozeau, M.D. (Duke, 1966); Jeffery M. Vance, M.D. (Duke, 1984); Kevan VanLandingham, M.D. (Virginia, 1985).

Assistant Research Professors: John R. Gilbert, Ph.D. (North Carolina at Chapel Hill, 1982); Sanjeev D. Nandedkar, Ph.D. (Virginia 1983).

Associates: James R. Burke, M.D. (New York at Brooklyn, 1985); Carmelo Graffagnino, M.D. (West-Ontario, 1985); Joel C. Morgenlander, M.D. (Pittsburgh, 1986); Warren J. Strittmatter, M.D. (Duke, 1973); Richard W. Tim, M.D. (California at San Diego, 1986).

DIVISION OF RHEUMATOLOGY AND IMMUNOLOGY

Professor: Frederic M. Hanes Professor of Medicine Barton F. Haynes, M.D. (Baylor, 1973), *Chief*.

Professors: Michael S. Hershfield, M.D. (Pennsylvania, 1967); Nicholas M. Kredich, M.D. (Michigan, 1962); David S. Pisetsky, M.D. (Albert Einstein, 1973); James B. Duke Professor of Medicine Ralph Snyderman, M.D. (New York, Downstate, 1965); James B. Wyngaarden, M.D. (Michigan, 1948).

Associate Professors: Nancy B. Allen, M.D. (Tufts, 1978); David S. Caldwell, M.D. (Bowman Gray, 1967); John R. Rice, M.D. (Miami, 1968); Michael F. Seldin, M.D. (Baylor, 1981).

Associate Research Professors: Thomas J. Palker, Ph.D. (Connecticut, 1982); Kay H. Singer, Ph.D. (Duke, 1977).

Assistant Professors: Gary S. Gilkeson, M.D. (Southwestern, 1979); Virginia B. Kraus, M.D. (Duke, 1982); Rex M. McCallum, M.D. (Vanderbilt, 1980); E. William St. Clair, M.D. (West Virginia, 1980).

Assistant Research Professors: Hydar Ali, Ph.D. (Univ. Coll. of London, 1986); Bodduluri Haribabu, Ph.D. (Indian Inst., 1984).

Associates: Mary R. Jacobs, M.D. (Illinois, 1985); Cheryl R. Robertson, M.D. (Kentucky, 1985); Michael R. Saitta, M.D. (Johns Hopkins, 1984).

Associate in the Research Track: M. Richardo Richardson, Ph.D. (Univ. of Barcelona, 1988).

ADJUNCT FACULTY

Professor of Experimental Medicine: James E. Nidel, M.D. (Miami, 1973).

Adjunct Professors of Medicine: A. Wallace Hayes, Ph.D. (Auburn, 1967); Calvin A. Lang, Sc.D. (Johns Hopkins, 1954).

Adjunct Associate Professor of Experimental Medicine: S. Duk Lee, Ph.D. (Maryland, 1961).

Adjunct Associate Professors of Medicine: Fredrick L. Dunn, M.D. (Illinois, 1974); John S. Penta, Ph.D. (Purdue, 1967); Thomas L. Wenger, M.D. (Boston, 1971).

Adjunct Assistant Professors of Medicine: Gary E. R. Hook, Ph.D. (Victoria, 1968); Richard Kent, M.D. (California at San Diego, 1975).

Adjunct Assistant Professor of Experimental Medicine: John J. O'Neil, Ph.D. (California at San Francisco, 1974).

CONSULTING FACULTY

Consulting Professors: David W. Barry, M.D. (Yale, 1969), Research Triangle Park, NC; Vincent Dennis, M.D. (Georgetown, 1966), Cleveland, OH; Robert A. Gutman, M.D. (Florida, 1962), Durham, NC; Eric N. Prystowsky, M.D. (Mount Sinai, 1973), Indianapolis, IN; Barry W. Rame, M.D. (Colorado, 1964), Albuquerque, NM; Eric J. Topol, M.D. (Rochester, 1979), Cleveland, OH.

Associate Consulting Professors: Arthur Frankel, M.D. (Illinois, 1979) Orlando, Florida; Robert S. Gilgor, M.D. (Pennsylvania, 1962), Chapel Hill, NC.; Harold L. Godwin, M.D. (Harvard, 1947), Fayetteville, NC.

Assistant Consulting Professors: Syed Ahmed, M.D. (Dow Med. Coll., 1967), Danville, VA; Roy M. Ambinder, M.D. (Columbia, 1975); Orlando, FL; Franc A. Barada, M.D. (Virginia, 1971), Durham, NC; Wayne D. Brenckman, M.D. (Yale, 1963), Durham, NC; J. Trig Brown, M.D. (Washington Univ., 1977), Durham, NC; Edwin Cox, M.D. (Duke, 1971), Durham, NC; Joan Drucker, M.D. (Virginia, 1980), Durham, NC; Philip H. Dunn, M.D. (Duke, 1976), Orlando, FL; Lewis D. Elliston, M.D. (Baylor, 1969), Asheville, NC; Paul R. Garrett, M.D. (Med. Coll. of Ohio,

1972); F. Roosevelt Gilliam, M.D. (Duke, 1981), Richmond, VA; Albino Gomez-Uria, M.D. (Madrid Sch. of Med., 1962), Asheville, NC; Gloria F. Graham, M.D. (Bowman Gray, 1961), Wilson, NC; N. Rebecca Haley, M.D. (Eastern Virginia, 1984), Charlotte, NC; Elizabeth Kanof, M.D. (New York Univ., 1960), Raleigh, NC; G. Wallace Kernodle, M.D. (North Carolina at Chapel Hill, 1981), Burlington, NC; William D. Kuehl, M.D. (Iowa, 1982), Asheville, NC; Douglas E. Lemley, M.D. (West Virginia, 1982), Concord, NC; Stewart Levine, M.D. (Columbia, 1978), Asheville, NC; Linville M. Meadows, M.D. (North Carolina at Chapel Hill, 1982), Sanford, NC; Gwenesta B. Melton, M.D. (Tulane, 1979), Fayetteville, NC; Michael J. Messino, M.D. (Ohio, 1974), Asheville, NC; Lefkos T. Middleton, M.D. (University of Louis Pasteur, 1976), Cyprus, Greece; Robert D. Mitchell, M.D. (Michigan, 1982); Concord, NC; Eva L. Morgenstern, M.D. (Connecticut, 1976), Asheville, NC; Rebecca L. Moroose, M.D. (Connecticut, 1980), Orlando, FL; Gautam K. Patel, M.D. (S.M.T.N.H.L. Municipal Medical Coll., 1976), Asheville, NC;

Brahmaji S. Puram, M.D. (Andhra Med. Coll., 1974), Asheville, NC; Vijayalakshmi Puram, M.D. (Guntar Med. Coll., 1972), Asheville, NC; Robert B. Reynolds, M.D. (Royal College of Surgeons, 1984), Longwood, FL; John B. Simpson, M.D. (Duke, 1973), Woodside, CA; David K. Smith, M.D. (Case Western Reserve, 1974), Orlando, FL; Abe Walston, M.D. (Duke, 1963), Durham, NC; James O. Wynn, M.D. (Cornell, 1951), Chapel Hill, NC; Lee H. Zehngebot, M.D. (Pennsylvania, 1976), Orlando, FL.

Consulting Associates: Faye T. Banks, M.D. (Virginia, 1982), Durham, NC; L. Thomas Barber, M.D. (George Washington, 1982), Durham, NC; Habib Bassil, M.D. (St. Joseph, 1980), South Boston, VA; Ira M. Bernstein, M.D. (Bowman Gray, 1970), Asheville, NC; Nayan K. Bhatt, M.D. (Sheffield Univ., 1981), Martinsville, VA; Alan M. Blaker, M.D. (Maryland, 1984), Florence, SC; Garrett Bressler, M.D. (Duke, 1978), Durham, NC; Louis L. Brunetti, M.D. (Mount Sinai, 1983), Charlotte, NC; A. Gray Bullard, M.D. (North Carolina at Chapel Hill, 1985), Sanford, NC; Paul R. Conkling, M.D. (Ohio, 1982), Norfolk, VA; James H. Cooke, M.D. (Duke, 1976), Concord, NC; Gary K. DeWeese, M.D. (Duke, 1986), Burlington, NC; Michael S. Dowling, M.D. (Case Western Reserve, 1983), Durham, NC; Manuel H. Enriquez, M.D. (East-Ramon Magsaysay, 1979), Asheville, NC; William A. Fintel, M.D. (Minnesota, 1983), Salem, VA; Richard Goulah, M.D. (St. George, 1982), South Boston, VA; Robert A. Harrell, M.D. (Johns Hopkins, 1980), Durham, NC; Vasundhara G. Iyengar, M.D. (Bangalore, 1970), Orlando, FL; Dennis C. Kabasan, M.D. (Univ. of Graz, 1977), Asheville, NC; Paul E. Kile, M.D. (Tufts, 1982), Louisburg, NC; Joseph M. Kmonicek, M.D. (Jefferson, 1980), Florence, SC; Stanley Levy, M.D. (Georgetown, 1971), Durham, NC; Wendy Lu Martin, M.D. (Rush, 1988), Research Triangle Park, NC; Ralph N. McDonald, M.D. (West Virginia, 1982), Hickory, NC; Michael M. Meighan, M.D. (Univ. of Northeast, 1980), Asheville, NC; Arnold I. Miller, M.D. (Kansas City, 1972), Orlando, FL; Gary P. Miller, M.D. (Virginia, 1976), Danville, VA; G. Radford Moeller, M.D. (Duke, 1977), Pollocksville, NC; Jorge G. Otoy, M.D. (Univ. of San Marcos, 1974), Orlando, FL; James E. Pope, M.D. (Eastern Virginia, 1978), Tampa, FL; Robert E. Pryor, M.D. (Baylor, 1986), Galax, VA; Joseph A. Puma, D.O. (New York Coll. of Osteopathy, 1985), Galax, VA; Veronica J. F. Ray, M.D. (North Carolina at Chapel Hill, 1979), Durham, NC; John D. Reed, M.D. (North Carolina at Chapel Hill, 1986), Concord, NC; David F. Rhodes, M.D. (Vanderbilt, 1985), Concord, NC; Paul D. Richards, M.D. (Tulane, 1979), Salem, VA; Jack G. Robbins, M.D. (Duke, 1948), Durham, NC; Michael S. Roberts, M.D. (Tufts, 1979), Orlando, FL; Manfred Rothstein, M.D. (Duke, 1974), Cary, NC; Stephen H. Royal, M.D. (New York, Downstate, 1981), Lumberton, NC; John M. Schillo, M.D. (Maryland, 1981), Asheville, NC; Willie J. Sessions, M.D. (Tufts, 1985), Henderson, NC; Robert K. Stack, M.D. (Wayne State, 1981), Charlotte, NC; John P. Stratton, M.D. (Harvard, 1961), Durham, NC; Janet K. Vasey, M.D. (Indiana, 1983), Asheville, NC; Boshra George Zakhary, M.D. (Ain Shams Univ. 1981), Danville, VA; William J. Zimmer, M.D. (Wisconsin, 1986), Martinsville, VA.

CLINICAL FACULTY

Clinical Professor: Robert Silber, M.D. (New York, Downstate, 1954).

Associate Clinical Professors: Charles Ellenbogen, M.D. (Chicago, 1964); Paul E. Klotman, M.D. (Indiana, 1976); Ares Pasipoularides, M.D. (Minnesota, 1971).

Assistant Clinical Professors: Dean A. Bramlett, M.D. (Illinois, 1976), St. Petersburg, FL; Mary E. Klotman, M.D. (Duke, 1980); Roderick B. Meese, M.D. (Cincinnati, 1981), Tyler, TX; Brant S. Mittler, M.D. (Duke, 1972), San Antonio, TX; Kenneth Morris, M.D. (Ohio, 1972); Frank Pancotto, M.D. (Chicago, 1975), Concord, NC.

Assistant Clinical Professor in Medicine: Linda Charles, Ph.D. (North Carolina at Chapel Hill, 1991).

Clinical Associates: Paul T. Campbell, M.D. (Temple, 1985), Concord, NC; Richard B. Everson, M.D. (Rochester, 1972), Research Triangle, Park, NC; Frank A. McGrew, M.D. (Case Western Reserve, 1970), Memphis, TN; William P. Petros, Ph.D. (Philadelphia Coll. of Pharm., 1987); Thomas F. Trahey, M.D. (Bowman Gray, 1984).

Emeriti: J. Lamar Callaway, M.D.; Albert Heyman, M.D.; Jacqueline C. Hijmans, M.D. (Univ. of Leiden, 1951); Walter Kempner, M.D.; Johannes A. Kylstra, M.D.; Harry T. McPherson, M.D.; Barbara Newborg, M.D.; Edward S. Orgain, M.D.; John B. Pfeiffer, M.D.; Richard M. Portwood, M.D. (Southwestern, 1954); Herbert O. Sieker, M.D.; Eugene A. Stead, Jr., M.D.; Malcolm P. Tyor, M.D.

Required Courses

MED-204. Introduction to Clinical Medicine. This seven week course occurs in late summer following the completion of the first year basic science curriculum. It is short but intensive and designed to provide the necessary skills and knowledge basic to function in a clinical environment. The three major areas that are covered include: (1) history, physical examination, problem formulation; (2) laboratory diagnosis, and (3) radiology diagnosis. In each of these three areas, didactic materials are presented in a morning lecture format and are complemented by afternoon sessions in smaller groups with "hands on" experience. The course also includes a brief introduction to the topic of human sexuality.

The morning lectures for the patient interaction part of the course concentrate on various organ systems and outline the salient historical features of normality and disease as well as the physical examination features pertinent to the organ system. Two afternoons each week, small student groups interact with one instructor, interview, examine, present, and write up patients from the wards at Duke and the VA Medical Center. During these patient oriented sessions, skills and techniques necessary for history taking, physical examination, bedside presentations, problem formulation, and writing up findings are introduced and practiced. Standardized patient instructors in the screening physical examination are also utilized.

The purpose of the laboratory diagnosis portion of the course is to teach the concepts and technical skills necessary for the use of the laboratory in evaluating and managing patients. It consists of a series of morning lectures and afternoon laboratory sessions stressing the intelligent use of the laboratory in clinical medicine and presented in a disease-oriented format. The lectures summarize difficult topics not easily gleaned from reading the background materials or handouts. The laboratory sessions are designed to serve two purposes: to allow acquisition of the basic psychomotor laboratory skills needed routinely in clinical medicine, such as venipuncture, cell counting, performance of ECGs and microscopic examination of urine and blood; and to provide an opportunity for small instructor-led groups to discuss the relevance of actual laboratory data to clinical practice.

The aim of the radiology diagnosis portion of the course is to introduce students to the radiographic appearances of common diseases that they will encounter during their clinical years. The principles rather than the details of radiographic interpretation are stressed in a series of morning lectures and afternoon laboratories sessions. In general, two lectures are devoted to each subspecialty area, e.g., chest radiology and neuroradiology, and these are usually scheduled to coincide with the corresponding lectures in physical and laboratory diagnosis. The laboratories are given to groups of fifteen to twenty students, and involve discussion of radiographs at the viewbox. The labs are generally designed to amplify and extend the content of the lecture material. The emphasis is on an informal discussion with considerable interaction between teacher and students. Most of the course material is related to the analysis of radiographs from the basic areas of radiology (chest, bone, gastrointestinal, urologic, and pediatric); with less emphasis on the more specialized areas (neuro, vascular, ultrasound, computed tomography, and nuclear medicine). Students will be expected to develop an understanding of how to analyze the common basic radiographic abnormalities that they will see during their second year clinical clerkships. The limited introduction to the more specialized areas provides information as to how the new imaging modalities should be applied in the diagnostic investigation of patients.

The human sexuality portion of the course provides a didactic introduction to the psychological and physiologic aspects of sexual response and sexual dysfunction that are commonly encountered in clinical practice. The treatment of sexual dysfunction, with emphasis on behavioral methods, along with other approaches to marital and sexual dysfunction are also discussed.

At the end of the course, the students are tested via a written and practical examination in radiology and laboratory medicine and both a written and practical examination on history, physical examination, and problem formulations. Also contributing significantly to the final evaluation is individual student performance during the afternoon ward sessions.

MED-205. Medicine. The second year course in medicine provides students with the basic tools used in the practice of medicine. This is the time for students to consolidate the material

learned during the first year and apply it to the study of their own patients. During an eight-week course it is not possible to cover systematically the entire body of knowledge of internal medicine; instead, students are provided a series of representative learning experiences based on the case study method. Our goals are to teach a method of approach to the patient and to provide a firm foundation for the solution of new medical problems as they are encountered in the months and years ahead. Specific expectations include the following: (1) Students will perform and record a history and physical examination on each patient they admit. The first two weeks on the rotation students will admit one patient per call night; thereafter, four patients per week. (2) Students will perform an independent history and physical examination on their patients. After the resident has completed the patient assessment, each student should present to the resident. They should then go back to the bedside to check any discrepancies in the historical or physical examination findings. (3) A complete work-up will include an analysis of the peripheral blood smear and urine sediment and sputum gram stain when appropriate. (4) Students should prepare for case presentations by reading the relevant sections in one of the standard textbooks of medicine. (5) The student's complete workup should be in the chart within twenty-four hours of admission in the format provided. (6) Students should take primary care responsibility for their patients following their patients daily and including progress notes on the chart. Students are responsible for knowing what therapeutic interventions and/or diagnostic tests have been performed and the outcome of these maneuvers. (7) Students are encouraged to participate in all diagnostic procedures, such as lumbar punctures or thoracenteses, on their patients. Where appropriate, students will perform these procedures under the supervision of the house staff. (8) Daily work rounds with the house staff are mandatory and students are expected to participate in patient care decisions. This will necessitate students seeing patients before work rounds. Attending rounds cannot be missed without the prior permission of the attending physician. (9) Students are expected to present patients to attending physicians within 24 hours after admission and to know the rationale for patient work-up and all pertinent medical information. (10) Students are required to sleep in the hospital every third night. They will assist in cross coverage with the intern as well as take care of their own patients. (11) Students should attend all Grand Rounds and Student Lecture Series unless ward duties preclude.

MED-207. Neurology. The second year course in neurology provides the student with a firm understanding of the neurological examination, formulation of clinical neurological problems, and practice with written and oral communications in a hospital setting. The student has the opportunity to apply the neuroanatomy, neurophysiology, neurochemistry, and neuropathology learned in the first year to the evaluation and care of his or her patients. Each student is assigned patients from the neurology services at Duke Hospital or the Durham VA Medical Center. The students elicit a history and perform a physical examination. The student records the findings in the hospital charts and presents the findings at regular staff rounds. The student then participates with a clinical team of faculty and house officers in the hospital evaluation of the patients. The student is encouraged to participate in all diagnostic procedures such as lumbar puncture. The student has the opportunity to follow patients through neuro-radiological and neuro-surgical procedures forming part of evaluation and treatment.

The specific expectations for the sophomore student are: (1) to perform and record a competent neurological and history examination on each admitted patient, (2) to be competent in the hospital management of neurological patients including diagnostic appropriate electrical studies, (3) to assume responsibility as the primary care person for his or her patients, to include daily progress notes on hospital charts, and to be familiar with the results of all therapeutic interventions and diagnostic tests performed on his patients, (4) to participate in daily work rounds with an assigned team of house officers and faculty, (5) to be sufficiently knowledgeable to be able to participate in patient care decisions, (6) to attend faculty attending rounds and to present his patients to faculty within twenty-four hours after admission, and (7) to participate in neurology service rounds and conferences during the course.

The course includes faculty lectures. A written evaluation is provided to the students by faculty and house staff. There is an examination.

This course is usually taken in conjunction with CFM-207.

Electives

MED-210C. Advanced General Medicine (Duke/Durham-VA). (1) Course Goals: To expand the experience and knowledge gained during the second year medicine clerkship. Primary—Providing additional experience in the management of hospitalized patients with a wide variety of general internal medical problems. Secondary—Developing a comprehensive understanding of the pathophysiology of the common problems encountered on an internal medicine inpatient service. This course is recommended for students who receive a straight grade of Pass in MED 205C. (2) How Goals Will Be Achieved: Students will be assigned to one of the general medical wards at either Duke or the VA Hospital. They will be assigned patients in rotation with the second year students on the service and will be expected to perform and complete an initial evaluation, develop a care plan, write the orders (to be countersigned by the intern), present the patient at teaching rounds, and follow the patient throughout the hospital course. Students will be assigned approximately three patients per week and will be expected to do outside reading on each. The student may be advanced to the subinternship level during the eight week period at the recommendation of the chief medical resident. (3) Methods of Evaluation: The evaluation form will be made available to each student at the beginning of the rotation. There will be formal mid-term and final evaluations. No final exam is given. Requests for Duke or Durham VA rotation will be accepted on first come, first served basis. Call 286-2995. Weight: 10 Max: 6. *Greenfield and staff*

MED-211C. Internal Medicine Subinternship (Duke/Durham-VA). (1) Course Goals: To provide an internal medicine patient care experience at the intern level. (2) How Goals Will Be Achieved: Students will be assigned to one of the two inpatient services at either Duke or VA and will be supervised by a second or third year internal medicine resident. The student will function as an intern on that service with the exception that orders must be countersigned by a medical house officer. A pager and sleep-in facilities will be available. No other medical intern will be assigned to those patients handled by the subintern. The number of patients assigned will be determined by the supervising resident with anticipated increases during the course. (3) Methods of Evaluation: Students will be evaluated by their resident and senior staff attending. The evaluation form will be made available to each student at the beginning of the rotation. There will be an informal evaluation at two weeks and a formal evaluation at four weeks. No final exam is given. Prerequisites: available only to Duke medical students who receive grades of Honors or P+ in MED 205C. Requests for Duke or Durham VA will be accepted on first come, first served basis. Call 286-2995. Weight: 5 or 10 Max: 13. *Greenfield and staff*

MED-213C. Tutorial in Medical PDC. (1) Course Goals: Primary—To broaden student exposure to ambulatory care in internal medicine and understanding of outpatient evaluation. Secondary—To develop the student's doctoring skills by focusing on the physician/patient interaction. (2) How Goals Will Be Achieved: Students will work in a one-to-one relationship with a faculty member in the Department of Medicine who see patients regularly in the Medical PDC. Students will complete the initial work-up of patients and develop plans for treatment and follow-up care in consultation with the preceptor. They may follow patients admitted to the hospital. Students may choose to spend time in the acute care clinic as well as seeing scheduled patients with a selected attending physician. The patients may be general medical patients or patients within their attending's subspecialty. (3) Methods of Evaluation: The preceptor will observe the student's interaction with patients and the quality of the work-ups including follow-up, care plans, and their implementation. Prerequisites: Students must prearrange their elective with an individual preceptor and communicate the preceptor's approval to Dr. Neelon (684-4307). Weight: 2 (10 hrs/wk for 8 weeks), 4 (20 hrs/wk for 8 weeks or 10 hrs/wk for 16 weeks), or 8 (full time for 8 weeks). *Neelon and staff*

MED-214C. Rural Health Elective. Through a seminar series and experiences working in a community-sponsored rural health clinic, students will begin to understand the forces

that impact health and health care in rural North Carolina. The seminar series includes speakers and discussion on such topics as the economics of health care, health education, worker health, environmental health, cultural and ethical bias in health care and community action for health care workers. Students organize volunteer staffing for the Fremont clinic, and orient and teach other students. Students should have volunteered for the North Carolina Student Rural Health Coalition in either year one or year two. The grade for this year-long course will be posted at the end of the second term. One credit per term will be awarded. C-L: CFM 214C. Weight: 2 Min: 1 Max: 10. *B. Sheline*

MED-216C. Summer Elective in Primary Care General Internal Medicine. Designed for under-represented minority students. Students will participate in an extensive seminar series, will learn about primary care general internal medicine by working in a variety of clinics, and will design a clinical epidemiology project. Prerequisites: Completion of application and approval of student by instructor. Weight: 4 Max: 2. *Wong*

MED-220C. Emergency Room. (1) Course Goals: Primary—To provide a broad exposure in the Emergency Room to clinical problems, emphasizing acute internal medicine in such a way that students can see patients before any other physician contact permitting the learner to make diagnoses and plan short-term "workups". Secondary—To develop students' ability to rapidly obtain history and shorten the amount of time required to do accurate physical examination, to enhance students' dexterity when performing minimally invasive procedures, and to teach the concepts of triage and prehospital care. (2) How Goals Will Be Achieved: Each student works with attending physicians and nine different residents (not interns). Each student will work approximately 18 to 20 twelve hour shifts and in general will not spend the night. In collaboration with residents or senior staff, students will be involved in diagnostic procedures and interpretation of studies before planning management of illness with some opportunities to supervise subsequent care for up to 24 hours. Thus, students can test their ability to make diagnoses and plan acute studies. Didactic sessions, held twice weekly, cover clinical topics related to emergency medicine and complement a daily morning report. Working with nurses at triage station permits view of a function rarely seen by learners of medicine. Every student is encouraged to ride in the ambulance with Durham County's paramedics. Students electing an eight week rotation double their experience in subacute internal medicine as described above, but also may elect to work on the acute side of the ER caring for patients who have myocardial infarction, life threatening arrhythmias, medical coma, pulmonary edema, status epilepticus, severe GI bleeding, and drug overdose. (3) Methods of Evaluation: Residents and senior staff evaluate the student's gain in rapidity of doing history/physical examinations, increased dexterity in performance of minimally invasive procedures, and increase in knowledge and skill to interpret/present data to others. Prerequisites: none mandatory, prior experience in other electives will be beneficial. Weight: 4 or 8 Min: 1 Max: 4. *Wellman*

MED-223C. Intensive Care Medicine Subinternship (Duke). (1) Course Goals: Primary—To introduce the student to a pathophysiologic approach to critically ill adults. Secondary— To provide an opportunity for students to perform selected procedures. (2) How Goals Will Be Achieved: Students will function as subinterns in a very active intensive care unit. Patient evaluations, procedures, diagnostic planning and treatment planning are performed by students under the direct supervision of the junior assistant resident, critical care fellow, and attending physician. Night call occurs every third night. Regular didactic lectures on topics related to the diagnosis and treatment of the critically ill will be given by the attending staff. The physiological and biochemical approach to critical care medicine is stressed. A syllabus of selected reprints from the critical care literature is provided to each student. Emphasis is placed on access to attending physicians and pulmonary fellows for the discussion of specific patient oriented questions. Preferences for the month of rotation will be honored if possible. Questions should be directed to Dr. Fulkerson, 681-5850. (3) Methods of Evaluation: Each student's performance is assessed by the unit director through direct

observation of the student in the clinical and didactic environments. Input from the residents, fellows, and other attending physicians is also obtained. Weight: 5 Max: 3. *Fulkerson and pulmonary staff*

MED-224C. Intensive Care Medicine Subinternship (Durham-VA Hospital). (1) Course Goals: Primary—To provide training in clinical physiologic and pharmacologic principles of the care of the critically ill. Secondary—To develop students' skills in performance and interpretation of diagnostic procedures. (2) How Goals Will Be Achieved: Under the supervision of junior assistant residents and a pulmonary fellow, students will function as subinterns and will be responsible for patient workups and daily bedside presentations. Students are given responsibilities for procedures and decision-making in direct proportion to the development of their patient management skills. Daily attending rounds stress an integrated physiologic approach to the management of critically ill patients with emphasis on acute respiratory care, hemodynamic monitoring, acid-base balance, and nutritional support. Each student is provided with a syllabus of selected readings that supplements regular didactic sessions on diagnosis, pathophysiology, and management of critical illness. Student on call schedule is every third night for the duration of this four-week course. Students may obtain information by telephoning 286-6946 or 684-6143 and should arrange for a replacement if they subsequently drop the course. (3) Methods of Evaluation: Student evaluations are done by the fellows and faculty attending on the MICU and are based on observed performance. Weight: 5 Max: 3. *Piantadosi and pulmonary staff*

MED-230C. Pulmonary Medicine. (1) Course Goals: Primary—To provide training in clinical aspects of pulmonary medicine. The primary diseases emphasized include asthma, chronic obstructive lung disease, pulmonary vascular diseases including pulmonary embolus, acute respiratory failure, hypersensitivity, interstitial and immunologic lung diseases and pulmonary manifestations of systemic illnesses, i.e., sarcoid, scleroderma, cystic fibrosis, etc. Secondary—To provide experience with pulmonary laboratory techniques including pulmonary function testing, cardio-pulmonary exercise testing, chest radiology, and bronchoscopy. (2) How Goals Will Be Achieved: Students will be assigned to the Pulmonary Consult Services at either the VA or at Duke Hospital. They will have primary responsibility for workup and presentation of selected patients on these services. All patients are presented and followed at daily rounds with fellows and faculty. Students will also participate in a half-day outpatient clinic each week. Joint seminars and conferences involving both the Duke and VA Consult Services are held each week to provide instruction in pulmonary function evaluation, pulmonary physiology, chest radiology, pulmonary pathology and clinical pulmonary medicine. (3) Methods of Evaluation: Student evaluations are done by fellows and faculty assigned to the Consult Services during the period of the course and are based on observed performance. Weight: 4 Min: 1 Max: 4. *Crapo and pulmonary staff*

MED-231C. Allergy-Immunology. (1) Course Goals: Primary—Precepted instruction in the critical use of medical laboratory information. Secondary—Familiarization of the student with the clinical uses of the Allergy-Immunology laboratory. (2) How Goals Will Be Achieved: The consultative role of the Allergy-Immunology laboratory is used to focus critical awareness on the clinical utility and pitfalls of laboratory studies. During the first two weeks, the student will clinically evaluate selected patients with altered immunity (impaired resistance to infection, hypersensitivity, autoimmunity, neoplasia or other immunologic problems) from the clinic and/or consultative service. This experience is used to identify an acceptable topic for selected readings and discussions focused on either laboratory procedures or an immune alteration associated with a disease. These readings and discussions provide the basis for a required short (ten to twenty double-spaced, typed pages excluding references), critical technical report on the utility of either a specific laboratory procedure or the value of laboratory studies in the care of patients with a specific immune disease. (3) Methods of Evaluation: The depth of the student's understanding of the problem, ability to

use the information reviewed, and the content of the technical report are used to evaluate student performance. Prerequisites: permission of instructor. Weight: 8 Max: 1. *Buckley*

MED-232C. Pulmonary Medicine Subinternship (Asheville VA). (1) Course Goals: Primary—To provide experience in management and assessment of pulmonary diseases. Secondary—To expose students to and permit them to assist in special procedures in pulmonary medicine such as PFTs, arterial punctures, thoracentesis, and bronchoscopy. (2) How Goals Will Be Achieved: Students will perform the initial workup on selected patients admitted to the pulmonary service at the AVAMC and participate in patient centered daily work rounds and weekly chest conferences. In addition, there will be informal lectures on pulmonary subjects such as history taking, physical examination, PFTs and arterial blood gases (theory vs practice), chest radiography, COPD and asthma, lung cancer, pneumonias, pulmonary TB, pulmonary emboli, occupational lung disease, respiratory failure, and pleural effusion. Optional activities may include participation in a pulmonary clinic and pulmonary medical night call. (3) Method of Evaluation: The instructor evaluation will be based on observation of the student's daily performance using the standard Duke Department of Medicine evaluation form. Weight: 4 Min: 1 Max: 2. *Elliston, Enriquez, and Rotman*

MED-242C. Clinical Arrhythmia Service. (1) Course Goals: Primary—To provide students with an in-depth exposure to the diagnosis and management of cardiac arrhythmias, electrophysiologic studies, cardiac pacemakers, and implantable defibrillators; to help students to understand the electrophysiologic events that result in arrhythmias and ECG changes. This course is not designed to be a substitute for the general cardiology elective (MED 240C). Secondary—To familiarize the student with certain basic techniques of arrhythmia diagnosis such as esophageal recording and pacing. (2) How Goals Will Be Achieved: The student will spend four weeks working on the Clinical Arrhythmia Service. The student will make rounds with the Clinical Electrophysiology Service on inpatients with arrhythmia problems. The student is encouraged to attend electrophysiologic studies and assist in the analysis of data from these studies. Attendance of electrophysiologic surgical procedures is also encouraged. The student will be responsible for the work-up of patients admitted to the Arrhythmia Service as well as inpatient consults and will play an important role in the follow up of these patients while they are in the hospital. The student will see outpatients during Arrhythmia Clinic that meets Wednesday afternoons in the PDC. The student will assist in the evaluation of patients for permanent pacemaker implantations. Students will be responsible for reviewing the literature on subjects related to the patients that they have seen on the clinical service. (3) Methods of Evaluation: Students will be evaluated on their clinical skills in taking histories, performing physical examinations as well as in their presentation and assessment of the patient's problem. They will also be assessed on their ability to read and understand the relevant literature and their ability to assume a responsible role in the care of patients on the Clinical Arrhythmia Service. Weight: 4 Max: 1. *Wharton, Pritchett, Grant, Greenfield, and Sorrentino*

MED-243C. Cardiology Subinternship (Asheville VA). (1) Course Goals: Primary—To provide experience in the assessment and management of patients with acquired heart disease. Secondary—To familiarize the student with both invasive and non-invasive procedures available at this medical center. (2) How Goals Will Be Achieved: The student will be assigned to an attending cardiologist and will be expected to work up patients presenting to both the coronary care unit and the cardiology nonacute ward. Daily work rounds will commence at 7:30 a.m. with additional student teaching rounds occurring three times a week. In addition, daily interpretation of electrocardiograms, stress tests, Holter monitors, and echocardiograms will focus on student teaching. Cardiac catheterization results will also be reviewed on a daily basis. Night call will be optional, but students may elect to take call with appropriate attendings. (3) Methods of Evaluation: The preceptor will evaluate the student's ability to assess patient problems based on the history and physical and to formulate a plan to evaluate the problems. Furthermore, the preceptor will assess each student's ability to

evaluate and act upon data derived from both invasive and non-invasive diagnostic methods. Weight: 4 Max: 2. *Puram, Levine, and Patel*

MED-244C. In-Patient Cardiology. (1) Course Goals: Primary—To provide an in-depth experience in the evaluation and care of in-patients with various cardiovascular problems requiring hospitalization. Secondary—To refine student understanding of the cardiovascular history, physical examination and non-invasive and invasive laboratory testing in evaluating and managing patients with known or suspected cardiovascular disease. (2) How Goals Will Be Achieved: Students will be assigned to the Duke CCU, the VA CCU, or to the private cardiology in-patient service at Duke. They will work in concert with the house staff, cardiology fellows, and senior staff attendings in working up and managing patients admitted to these various services. They will also participate in a core curriculum experience, including individually assigned times to work with the cardiology patient simulator and various computer assisted instruction programs. Because of the considerable logistics involved in scheduling and coordinating the various cardiology electives, students who wish to drop must do so at least one week before the scheduled starting date. After that time, drops will be allowed only if a replacement student can be provided. (3) Methods of Evaluation: Students will be evaluated by all resident, fellow, and senior staff with whom they work. The evaluation questionnaire will be made available at the beginning of the elective. Depending on circumstances, students may also be evaluated by written and practical examinations at the beginning and/or end of the elective. Weight: 5 Min: 1 Max: 6. *Waugh*

MED-245C. Consultative Cardiology. (1) Course Goals: To refine student understanding of normal and pathologic cardiovascular physiology while functioning in the role of a consultant for in-patients with various cardiovascular problems; to develop the skills necessary to quickly and accurately interpret ECGs. (2) How Goals Will Be Achieved: Students will be assigned to the consult service at either the VA Hospital, Duke, or, as availability/interest permits, the Electrophysiology Service at Duke where, in concert with the SAR, fellow and senior staff attending, they will evaluate the operative risk for non-cardiac surgery as well as make decisions concerning cardiac surgery in patients with ischemic and other types of heart disease. Students will also participate extensively in reading ECGs. They will also participate in a core curriculum experience including individually assigned times to work with the cardiology patient simulator and various computer assisted instruction programs. Because of the considerable logistics involved in scheduling and coordinating the various cardiology electives, students who wish to drop must do so at least one week before the scheduled starting date. After that time, drops will be allowed only if a replacement student can be provided. (3) Methods of Evaluation: Students will be evaluated by the resident, fellow, and senior staff with whom they work. The evaluation questionnaire will be made available at the beginning of the elective. Depending on circumstances, students may also be evaluated by written and practical examinations at the beginning and/or end of the elective. Weight: 4 Min: 1 Max: 7. *Waugh and cardiology staff*

MED-250C. Clinical Dermatology. Course Goals: To train students to notice and recognize both crucial and trivial dermatological physical findings so that they may be able in the future to: (1) describe physical findings in the skin accurately; (2) formulate a reasonable differential diagnosis based on what is seen; (3) know when biopsy or referral is indicated; (4) prescribe appropriate therapy; and (5) recognize important dermatologic findings related to significant health problems. Students on the rotation will spend two weeks in the Duke clinics and two weeks at the V.A. Hospital. While at Duke, students will rotate through Private Dermatology Clinics, Public Dermatology Clinics, Dermatologic Surgery Clinics, and various sub-specialty clinics. At the V.A., there will be two major Outpatient Clinics each week supplemented by daily Acute Care Clinic/Screening-Clinic/ER walk-in consultations. Students will also participate in the inpatient consult services and will assist in the supervision of inpatient dermatology patients. There is no night or weekend call on

the rotation. The clinic experiences are supplemented with lectures and teaching conferences. Interesting cases from the V.A. experience are presented weekly at a Thursday morning conference. The majority of the teaching is one-on-one. Student evaluations are based on development of clinical skills as assessed by faculty and residents, presentations at weekly conferences, and a written and Kodachrome objective examination given at the end of the course. Any special needs can be discussed with the course director who may be reached at 684-5146. Students are to report to the Dermatology Clinic, Room 0027, Orange Zone at 0830 the first day of the rotation for further orientation and clinic assignment. Weight: 4 Max: 4. *Prose*

MED-251C. Lectures And Demonstration in Clinical Dermatology. (1) Course Goals: To familiarize students with the pathophysiology, clinical presentation, and treatment of dermatological disorders. (2) How Goals Will Be Achieved: The course will be presented over an eight week period with two lectures weekly by our dermatology faculty using 35mm Kodachromes. Clinical correlation will be graphically illustrated by student attendance of the bimonthly Duke/UNC conferences held alternately at Duke and UNC. At these conferences, five to eight patients with unusual dermatological diseases or management questions are presented and discussed by the faculty and residents of both university dermatology departments and approximately twenty dermatologists from the surrounding area. (3) Methods Of Evaluation: Course will be pass/fail dependent upon attendance of lectures and conferences. Those wishing to apply for honors must contact the course director at the onset of elective and choose a pertinent topic in dermatology to be reviewed and presented orally to the group at completion of the rotation. Weight: 2 Min: 15 *Olson and dermatology staff*

MED-260C. Gastroenterology. (1) Course Goals: Primary—To provide an experience with digestive diseases from which the student can develop a sound fundamental approach to the diagnosis and management of these problems. Secondary—To provide an exposure to recent advances in the field including therapeutic and diagnostic endoscopy; to stimulate questions concerning digestive diseases and to attract students into the field. (2) How Goals Will Be Achieved: Participation in the care, work-up and management of patients hospitalized on the general wards of Duke or the VA Hospital under the guidance of the resident, fellow, and faculty members assigned either to the VA or Duke Consultation Service. The students' experience may include participation in the activities of the new clinic endoscopy unit of the Division of Gastroenterology. This unit offers specialized tests and/or procedures necessary for the state of the art care of patients with digestive diseases. Procedural activities include upper endoscopy, endoscopic retrograde cholangiopancreatography, colonoscopy and polypectomy and endoscopic papillotomy of the ampulla of Vater. Data derived from these and other laboratory studies are discussed in the context of specific patient problems in weekly conference settings. Students have an opportunity to interact with all the faculty of the Division at morning rounds and other conferences where patients from all of the services (Duke and VA) are discussed. (3) Methods of Evaluation: Student evaluation forms are completed by the resident, fellows, and faculty working with the student on individual patient care services. Final evaluation represents a composite of these forms that chiefly identifies clinical skills, fund of basic information, organizational ability, and degree of interest and participation. Weight: 4 Max: 5. *I. L. Taylor and gastroenterology staff*

MED-270C. Outpatient Hematology-Oncology (Duke or Durham VA). (1) Course Goals: To give the student experience in the diagnosis, long-term treatment, and supportive care of patients with hematologic and oncologic disorders in the outpatient setting. The use and interpretation of peripheral blood films and other specialized laboratory tests (e.g., bone marrow aspirate/biopsy, serum electrophoresis, coagulation studies, tumor markers, leukemia cell markers), as well as an approach to the evaluation and treatment of common hematologic problems (anemias, bleeding and clotting disorders, hematologic and solid tissue malignancies) will be included. Issues such as quality of life and care of the geriatric oncology patient will be addresses. (2) How Goals Will Be Achieved: The student will be

assigned a staff member as preceptor with whom to work in the Hematology/Oncology clinic one half day per week. If desired, a preceptor who concentrates mainly on hematology or oncology may be arranged. This course is offered for eight or, preferably, sixteen weeks. (3) Methods of Evaluation: Students will be evaluated by their preceptors on the basis of their ability to obtain a history, perform a physical examination, evaluate hematologic and other laboratory data, and propose assessments and plans of action. Weight: 1-2 Max: 4. *Kaufman and hematology/oncology staff*

MED-272C. Clinical Hematology and Oncology (Duke or Durham VA). (1) Course Goals: Students will learn how to interpret peripheral blood films, how to use and interpret other specialized laboratory tests (e.g., bone marrow aspirate/biopsy, serum electrophoresis, coagulation studies, tumor markers, leukemia cell markers), and how to approach the evaluation and treatment of common hematologic problems (anemias, bleeding and clotting disorders, hematologic and solid tissue malignancies). (2) How Goals Will Be Achieved: Students will receive a series of core lectures, gain familiarity with chemotherapy regimens and administration, and attend the ongoing clinical, research, and didactic divisional conferences. Clinical duties will be the performance of inpatient consults under the supervision of a fellow and staff member. Students may opt to pursue a broad experience in hematologic and oncologic problems or may choose to focus on a particular area, e.g., coagulation and transfusion, experimental therapeutics of malignancy, bone marrow transplant, hemoglobinopathies. Students choosing the broad experience may elect to spend one week on the coagulation/transfusion consult service. This course may be taken for four or eight weeks. (3) Methods of Evaluation: The student will be expected to perform and present initial evaluations of consult cases including peripheral blood film on daily rounds, to perform a limited literature search and evaluation of a chosen clinical topic, and to present a case at the divisional clinical case conference. Weight: 4 or 8 Max: 4. *Kaufman and hematology/oncology staff*

MED-274C. Medical Subinternship in Hematology-Oncology. (1) Course Goals: This is an intensive experience in the care of inpatients with serious hematologic and oncologic disorders. The student will learn to interpret peripheral blood films, how to use and interpret other specialized laboratory tests (e.g. bone marrow aspirate/biopsy, serum electrophoresis, coagulation studies, tumor markers, leukemia cell markers), and how to approach the evaluation and treatment of hematologic and solid tissue malignancies and their complications. (2) How Goals Will Be Achieved: Under supervision of a Hematology/Oncology fellow and a division staff member, the student will be given considerable responsibility in the care of inpatients on one of the Hematology/Oncology or Experimental Therapeutics wards in Duke North. They will receive instruction and guidance in performing diagnostic and therapeutic procedures and gain experience in the use of chemotherapeutic drug regimens. Specific issues such as quality of life, care of the aging patient with malignancy, and decisions regarding DNR status will be addressed by the patient-care team. In addition, students will receive a series of core lectures, receive training in chemotherapy, and attend the ongoing clinical, research and didactic divisional conferences. (3) Methods of Evaluation: Students will be evaluated by their preceptors on the basis of their ability to obtain a history, perform a physical examination, evaluate hematologic and other laboratory data, and propose assessments and plans of action. Prerequisite: Approval of the faculty based on prior performance. Weight: 5 Max: 4. *Kaufman and hematology/oncology staff*

MED-275C. Clinical Coagulation. (1) Course Goals: Primary—To teach the clinical and laboratory approach to patients with a hemorrhagic or thrombotic disorder. The student will learn to evaluate clinical coagulation disorders and become familiar with coagulation laboratory testing and interpretation. Secondary—To expose the student to recent advances in the area of coagulation research. (2) How Goals Will Be Achieved: The student will spend four weeks on the Clinical Coagulation Consult Service under the direction of Dr. B. Gail Macik, Dr. Charles Greenberg, or Dr. William Kane. The student will be expected to work-up

inpatients referred to the Coagulation Service as well as participate in a half day a week Coagulation Outpatient Clinic. The rotation includes Coagulation lab rounds during which the student will learn to interpret lab tests and review abnormal results. The student will be expected to present patients at the weekly clinical coagulation conference and to briefly discuss the evaluation and management of the patient supported by a limited literature review. Students electing to do an eight week rotation will have a more extensive laboratory and clinical research experience. (3) Methods of Evaluation: The student's performance will be evaluated by the Coagulation attending with input from the fellow on the service. The evaluation will be based on observation of the student's ability to do careful histories and physical examinations, to appropriately assess the problem and develop a logical diagnostic and therapeutic plan, and to demonstrate an increase in knowledge about laboratory tests and their application to clinical problems. Weight: 4 or 8 Max: 2. *Macik, Greenberg, and Kane*

MED-276C. Oncology Subinternship (Asheville VA). (1) Course Goals: To provide the student with a broad experience in the medical management of oncology patients including initial diagnostic evaluation, planning, and monitoring of therapy and supportive care. Nonmalignant hematologic problems (mainly anemia and coagulopathy) will also be covered. (2) How Goals Will Be Achieved: The student will do admission work-ups, write orders, and serve as the primary care provider for selected oncology and hematology patients under the supervision of the Chief of Oncology, VAMCA. Didactic sessions will be provided by medical staff on various aspects of cancer and its treatment and complications. Students will be instructed to do bone marrow aspiration and biopsy and review peripheral and bone marrow smears. The student will participate twice weekly in the oncology/hematology clinic and evaluate inpatients with oncologic problems, anemia or coagulopathy on a consultative basis under staff supervision. (3) Method of Evaluation: Chief of Oncology Service will evaluate student with standard Duke Department of Medicine evaluation forms. Weight: 4 Max: 1. *Puram*

MED-280C. Clinical Infectious Diseases. (1) Course Goals: To provide experience in the clinical and laboratory diagnosis of infectious diseases and in their therapy. The primary emphasis will be placed on learning from interaction with patients, resident staff, and faculty on the consultation service. Students are expected to work up assigned patients by interview, physical examination, and collation of laboratory results, leading to a summary and synthesis of the problem. Particular emphasis will be placed on close follow-up of the patients during hospitalization, including attendance at procedures or operations whenever possible. Students should know their own patients well enough to be able to give a reasonable presentation on ward rounds or at conferences without notice. Students will be expected to read standard texts in-depth about their patients' problems, as well as a few recent relevant primary references. Students are expected to attend the various conferences listed on the weekly schedule of division activities punctually including Microbiology Plate Rounds, Journal Club, and tutorials. They will be asked to present cases and provide some discussion at the Thursday VA. Conference. Each student should be prepared to present and briefly discuss articles that he or she considers to be interesting and timely at Journal Club. (2) Methods of Evaluation: Each student's performance will be evaluated and graded by the resident, fellow, and attendings, using the usual "honors," "pass plus," "pass," "deferred," or "unsatisfactory" system that is utilized internally in the Department of Medicine. In arriving at a consensus, appropriate emphasis will be placed on knowledge, enthusiasm, and evidence of improvement during the rotation. There will be no written examination. Adds will be accepted at any time providing the course has not been filled. However, because this course is usually oversubscribed, drops will not be accepted within thirty days of the first day of classes unless the student finds his own replacement. MED 280C is a full-time experience. Also, it is offered as a sole-enrollment course and, as such, cannot be taken in conjunction with any other course without the permission of the advisory dean and the course director. Weight: 4 Max: 5. *Durack and infectious diseases staff*

MED-280C. Clinical Infectious Diseases. (1) Course Goals: To provide experience in the clinical and laboratory diagnosis of infectious diseases and in their therapy. The primary emphasis will be placed on learning from interaction with patients, resident staff, and faculty on the consultation service. Students are expected to work up assigned patients by interview, physical examination, and collation of laboratory results, leading to a summary and synthesis of the problem. Particular emphasis will be placed on close follow-up of the patients during hospitalization, including attendance at procedures or operations whenever possible. Students should know their own patients well enough to be able to give a reasonable presentation on ward rounds or at conferences without notice. Students will be expected to read standard texts in-depth about their patients' problems, as well as a few recent relevant primary references. Students are expected to attend the various conferences listed on the weekly schedule of division activities punctually including Microbiology Plate Rounds, Journal Club, and tutorials. They will be asked to present cases and provide some discussion at the Thursday VA. Conference. Each student should be prepared to present and briefly discuss articles that he or she considers to be interesting and timely at Journal Club. (2) Methods of Evaluation: Each student's performance will be evaluated and graded by the resident, fellow, and attendings, using the usual "honors," "pass plus," "pass," "deferred," or "unsatisfactory" system that is utilized internally in the Department of Medicine. In arriving at a consensus, appropriate emphasis will be placed on knowledge, enthusiasm, and evidence of improvement during the rotation. There will be no written examination. Adds will be accepted at any time providing the course has not been filled. However, because this course is usually oversubscribed, drops will not be accepted within thirty days of the first day of classes unless the student finds his own replacement. MED 280C is a full-time experience. Also, it is offered as a sole-enrollment course and, as such, cannot be taken in conjunction with any other course without the permission of the advisory dean and the course director. Weight: 4 Max: 5. *Durack and infectious diseases staff*

MED-290C. Metabolism and Endocrinology. (1) Course Goals: Primary—The student will have an in-depth experience in the evaluation and management of patients with endocrine disorders. Secondary—The student will learn basic principles of hormone physiology and apply these concepts in clinical settings. (2) How Goals Will Be Achieved: Each student will be introduced to patient problems by working with the Endocrine Faculty (Drs. Burch, Clark, Domalik, Drezner, Econs, Ellis, Feinglos, Guyton, Hanley, Harper, Johnson, Weintraub or McNeill). Prior arrangements may be made with a particular faculty member under the appropriate course number. Students will be exposed to clinical endocrine disorders by seeing patients in four endocrine outpatient clinics (Bone and Mineral, Diabetes, General Endocrine, and VA General Endocrine Clinic), as well as dividing their inpatient experience between the Diabetes Management/Lipid Consult Service and General Endocrine Consult Service. The student will have the opportunity to review general literature on common endocrinologic conditions and endocrinologic emergencies as well as learning basic assessment skills of the patient with diabetes, thyroid disease, and other common endocrinologic presentations. Division conferences include Grand Rounds, Research Seminar, Inpatient Attending Rounds, and Consult Rounds with opportunities to integrate basic concepts with clinical applications. (3) Methods of Evaluation: A written critique will be provided by the student's preceptors with comments from other members of the division as appropriate. Weight: 4 Max: 3. *McNeill and endocrinology staff*

MED-293C. Diabetes Mellitus Subinternship (Asheville VA). (1) Course Goals: Primary—To provide the student with an in-depth experience in the management of patients with diabetes mellitus and its complications. Secondary—To teach the student the physiology of insulin and counter-regulatory hormones and intermediate carbohydrate metabolism; to provide the student with an understanding of the pathophysiology of diabetes mellitus and its complications. (2) How Goals Will Be Achieved: The student will work up and write the orders on the patients with diabetes admitted to the Endocrine Section at AVAMC. The student will also participate in the Diabetes Clinic held four times weekly at the outpatient

department at the AVAMC. Daily rounds and outpatient work will be supervised by the Staff Endocrine Section. In addition, the student will participate in the care of diabetic retinopathy at the General Ophthalmology and Retinal Clinics, supervised by Ophthalmology staff (examination, laser beam therapy, etc.). The student will participate in the diabetic training program, the Endocrine Conference, Journal Club, and Foot Clinic. (3) Methods of Evaluation: Endocrinology Staff will evaluate the student with standard Duke Department of Medicine student evaluation forms. Weight: 4 Max: 1. *Gomez-Uria and Katz*

MED-300C. Nephrology. (1) Course Goals: Primary—To provide clinical experience in the diagnosis, assessment and treatment of renal diseases and hypertension. Secondary—To integrate renal physiology, immunology, pathology, and biochemistry into the clinical assessment of renal diseases. (2) How Goals Will Be Achieved: Students participate fully in both inpatient and outpatient assessment of patients presenting with fluid and electrolyte disorders, problem hypertension, acute renal failure, end-stage renal disease, and related complications. The student rounds daily with a renal fellow or senior resident, attends regular faculty teaching rounds and scheduled conferences devoted to correlations with basic science review of renal biopsy material, transplantation, etc. Special emphasis is placed on renal physiology and pathophysiology, renal histopathology, and hypertension. Students may elect to participate at the VA Hospital or on the private or nonprivate services at Duke. (3) Methods of Evaluation: Written comments from the faculty. Weight: 4 Max: 4. *Yarger and nephrology staff*

MED-301C. Fluids and Electrolytes. (1) Course Goals: Primary—To provide an applied approach to the management of fluid and electrolyte problems encountered in clinical medicine. To do this, cases are presented as problem-solving examples. The goal is to develop a systematic approach to the analysis of specific electrolyte derangements and to the correct selection of appropriate intravenous replacement therapy. These case studies are interwoven with a series of lectures designed to review specific areas such as compartmentalization of body fluids, derangements in acid-base balance, diuretic selection and use, analysis and approach to the treatment of potassium problems, etc. Secondary—To integrate basic renal physiology with clinical problems of fluid and electrolytes metabolism. (2) How Goals Will Be Achieved: Classroom experience. Does not involve patient exposure. (3) Methods of Evaluation: Final exam. If permitted by the instructor, this clinical science course can be audited. Weight: 2 Min: 6. *Yarger and nephrology staff*

MED-307C. Neurology Clerkship. This course is restricted to those students who did not take the Neurology rotation in their second year. It provides the student with a firm understanding of the neurological examination, formulation of clinical neurological problems, and practice with written and oral communications in a hospital setting. The student has the opportunity to apply the neuroanatomy, neurophysiology, neurochemistry, and neuropathology learned in the first year to the evaluation and care of his or her patients. The patients are drawn from the neurology services at Duke Hospital or the Durham VA Medical Center. The students elicit a history and perform a physical examination. The student records the findings in the hospital charts and presents the findings at regular staff rounds. The student then participates with a clinical team of faculty and house officers in the hospital evaluation of the patients. The student is encouraged to participate in all diagnostic procedures such as lumbar puncture. The student has the opportunity to follow patients through neuro-radiological and neuro-surgical procedures forming part of evaluation and treatment. The specific expectations for the student are: (3) to perform and record a competent neurological and history examination on each admitted patient; (b) to be competent in the hospital management of neurological patients including diagnostic evaluations such as hematological and urine evaluations, lumbar puncture and appropriate electrical studies; (c) to assume responsibility as the primary care person for his or her patients; (d) to participate in daily work rounds with an assigned team of house officers and faculty; (e) to be sufficiently knowledgeable to participate in patient care decisions; (f) to attend faculty attending rounds

and to present his patients to faculty within twenty-four hours after admission; and (g) to participate in neurology service rounds and conferences during the course. The course includes faculty lectures. A written evaluation is provided to the students by faculty and house staff. There is an examination. Weight: 4 Max: 1. *Morgenlander and neurology staff*

MED-308C. Clinical Neurology Subspecialties. (1) Course Goals: To provide the student to clinical exposure to a specific subspecialty in neurology. (2) How Goals Will Be Achieved: The student will focus on one specific subspecialty in neurology and will attend clinic for 2-4 hours weekly. During that time the student will participate in the clinical evaluation of patients with a member of the neurology faculty. Clinical experience in General Neurology, Neuromuscular Diseases, Epilepsy and Sleep Disorders, Memory Disorders, or Neuro-oncology are available. Appropriate reading material will be utilized to complement the clinical experience. MED 207C or MED 307C are prerequisites for this course. (3) Method Of Evaluation: Standard written evaluation form by faculty supervisor. Approval by the course director in order to ensure access to the desired neurologic subspecialty is required. Weight: 1-2 Max: 5 (if participating in different subspecialties). *Morgenlander and neurology staff*

MED-309C. Consultative Neurology. (1) Course Goals: To introduce senior medical students to the diagnostic and treatment issues encountered on the consultative neurology service. (2) How Goals Will Be Achieved: The student will become part of the inpatient neurology consultation team either at Duke Hospital or the Durham VA Hospital. This team will consist of senior neurology attendings on a rotating basis as well as a neurology and/or medicine house officer. Consultations will be performed by the student under the guidance of the house staff and then will be presented to the attending on rounds. The student will be responsible for performing a neurologic history and physical as well as assisting in the interpretation of all important laboratory data. The student will continue to follow the patient's course as required. The student will also attend rounds when other patients are presented by the house officers. Appropriate reading material will be utilized to compliment the clinical experience. Attendance at Neurology Grand Rounds and various Neurologic Subspecialty Conferences will be required. Experience on an inpatient neurology service such as MED 207C or MED 307C are prerequisites for this course. (3) Method Of Evaluation: Standard written evaluation by faculty supervisor with house staff input. Weight: 4 Max: 2. *Morgenlander and neurology staff*

MED-310C. Neurology Subinternship. (1) Course Goals: To provide a neurological patient care experience at the intern level. Students will have the opportunity to apply neurological examination skills learned in the second year to direct patient care situations. Students will be exposed to a variety of neurological problems, procedures, and therapies. This course is recommended for the student interested in neurology, psychiatry, internal medicine, neurosurgery, neuropathology or ophthalmology or those students wishing to supplement experience in Med 207 (Neurology Clerkship) or Med 211C (Internal Medicine Subinternship). Students may combine Med 211C with this course to provide advanced clinical training in internal medicine with an emphasis on neurology. (2) How Goals Will Be Achieved: Students are assigned to the Duke or Durham VA Hospitals' neurology ward and take call in rotation with a medical intern as part of a patient care team. Students attend Neurology-Neurosurgery Grand Rounds, Medicine Grand Rounds, Neuropathology Conferences and participate in all VA ward activities. Full time participation is expected. (3) Methods of Evaluation: Resident and staff physician provide a written evaluation and grade. Weight: 5 Min: 1 Max: 1. *Morgenlander and neurology staff*

MED-320C. Rheumatic and Immunological Diseases. (1) Course Goals: Primary—To provide the student with experience in the recognition and care of patients with rheumatic, inflammatory disease and immunological disease with particular attention to the various forms of arthritis, connective tissue disease, vasculitis and metabolic arthropathies. Secondary—To have the student achieve exposure to interpretation of the specialized laboratory

and clinical techniques relating to evaluation of patients with rheumatic, immunological, and metabolic disorders. Joint aspiration and injection, synovial fluid analysis, bone and joint radiology, histopathological analysis of tissue biopsy and interpretation of related serological testing will also be studied. (2) How Goals Will Be Achieved: Students will evaluate patients at the Duke and Durham VA Hospitals. Daily rounds will be held with faculty and house officers with emphasis on presentation of patients with detailed review of associated laboratory, x-ray and pathological findings. Basic Science Conference, Bone and Joint Radiology Conferences, Pathology Conference and Rheumatology/Immunology Grand Rounds are held at regular weekly intervals. A comprehensive approach to the evaluation and treatment of patients with rheumatic, inflammatory, immune and metabolic disorders is emphasized. Patients are assigned primary house officer level responsibilities on the Consultation Service at the Duke or Durham VA Hospitals. In addition to consult and inpatient responsibilities, students will be assigned to ambulatory care clinics at both hospitals and participate in all scheduled functions of the Division. (3) Methods of Evaluation: Student evaluations are based on patient presentations, participation and discussions on rounds and in conferences, and their functions in the outpatient clinics. This is a sole-enrollment course and, as such, cannot be taken in conjunction with any other course. Weight: 4 Max: 4. *McCallum and rheumatology/immunology staff*

MED-321C. Introduction to Clinical Rheumatology. (1) Course Goals: An introductory course in Clinical Rheumatology designed to introduce students to the basics of differential diagnosis in the field of rheumatic disease; to provide more detailed knowledge of the most common, major groups of rheumatic disorders. (2) How Goals Will Be Achieved: Didactic and interactive lectures will be the primary mode of teaching. Handouts and outlines on relevant topics and the Primer of Rheumatic Diseases will be provided at the beginning of the course. One or more sessions(s) will be devoted to patient presentations, with several patients available for questioning and discussion. Basic pathophysiology, clinical features, laboratory studies, radiographic findings and pathology correlations will be presented. (3) Methods of Evaluation: Participation in class and discussion of subject matter in concluding session. Course director will evaluate student with standard Duke evaluation. Weight: 1 Min: 3 Max: 20. *N. Allen and rheumatology staff*

MED-400C. Geriatric Medicine. (1) Course Goals: Primary—To enable the student to become familiar with the principles of caring for the geriatric patient. Secondary—To familiarize the student with the physiology and diseases of aging. (2) How Goals Will Be Achieved: This elective is offered by the interdepartmental faculty of the Division of Geriatric Medicine. The student will work with faculty, fellows, and housestaff in a number of settings involved in the care of the geriatric patient. These will include the Geriatric Evaluation and Treatment Clinic (Duke), Geriatric Evaluation Unit and Clinic (VA), Geriatric Consultation Services (VA, Duke), extended care and rehabilitation center (VA) and other nursing home facilities, interactions with community services, home assessment and other. Principles to be stressed will be biology and pathophysiology of aging, multiple clinical problems in the elderly, interdisciplinary team approach to evaluation, planning and treatment, goals of maximal functional achievement and independence for the elderly. The student will participate actively in the workup and management of patients in inpatient extended care and outpatient settings as well as become more familiar with the problems of the elderly in the community. Familiarity with the growing literature in geriatric medicine will be encouraged and the student will participate in seminars, lectures and team meetings at the appropriate sites including the Duke Center for the Study of Aging. (3) Methods of Evaluation: Evaluation will be by consensus of instructors and fellows at the various training sites. It will be based on discussions and presentations throughout the course period. Prerequisites: approval of course director. Weight: 4 Max: 2. *Cohen and staff*

Microbiology

Professor Jack D. Keene, Ph.D. (Washington, 1974), *Interim Chairman.*

Professors: Robert C. Bast, Jr., M.D. (Harvard, 1971); Deepak Bastia, Ph.D. (Chicago, 1971); Dani P. Bolognesi, Ph.D. (Duke, 1967); David T. Durack, D.Phil. (Oxford, 1973); Sharyn A. Endow, Ph.D. (Yale, 1975); Joseph R. Nevins, Ph.D. (Duke, 1976); Catherine M. Wilfert, M.D. (Harvard, 1962); Hilda P. Willett, Ph.D. (Duke, 1949).

Adjunct Professors: James J. Burchall, Ph.D. (Illinois, 1963); Norman F. Weatherly, Ph.D. (Kansas, 1962).

Emeritus: Suydam Osterhout, M.D. (Duke, 1949), Ph.D. (Rockefeller Inst., 1959); Robert W. Wheat, Ph.D. (Washington Univ., 1955).

Associate Professors: Bryan R. Cullen, Ph.D. (New Jersey, 1984); John D. Hamilton, M.D. (Colorado, 1964); Gale B. Hill, Ph.D. (Duke, 1966); Dolph Klein, Ph.D. (Rutgers, 1961); Kenneth N. Kreuzer, Ph.D. (Chicago, 1978); Elwood A. Linney, Ph.D. (California at San Diego, 1973); Thomas G. Mitchell, Ph.D. (Tulane, 1971); Stephen W. White, D. Phil. (Oxford, 1978); Peter Zwadyk, Jr., Ph.D. (Iowa, 1971).

Associate Research Professors: Vickers Burdett, Ph.D. (Georgetown, 1973); Lizzie J. Harrell, Ph.D. (North Carolina State, 1978); Sara E. Miller, Ph.D. (Georgia, 1972).

Adjunct Associate Professor: Jeffrey J. Collins, Ph.D. (Harvard, 1972).

Assistant Professors: Harry A. Gallis, M.D. (Duke, 1967); Mariano A. Garcia-Blanco, M.D., Ph.D. (Yale, 1984); Donald L. Granger, M.D. (Utah, 1972); Russell P. Hall, M.D. (Missouri, 1975); Jonathan M. Horowitz, Ph.D. (Wisconsin, 1985); Ross E. McKinney, Jr., M.D. (Rochester, 1979); Michael C. Ostrowski, Ph.D. (South Carolina, 1979); John R. Perfect, M.D. (Med. Coll. of Ohio, 1974); David J. Pickup, Ph.D. (National Institute of Medical Research, London, 1979); Michael F. Seldin, M.D. (Baylor, 1981), Ph.D. (Baylor, 1979); Daniel J. Sexton, M.D. (Northwestern, 1971); Robin P. Wharton, Ph.D. (Harvard, 1986).

Assistant Research Professor: Michael R. Roner, Ph.D. (Miami, 1986).

Adjunct Assistant Professor: Lynn P. Elwell, Ph.D. (Oregon, 1974).

Associate: David W. Hoffman, Ph.D. (Duke, 1986).

Research Associates: L. Andrews, Ph.D.; J. Antczak, Ph.D.; R. Bentley, M.D.; R. Chandra, Ph.D.; M. Colbert, Ph.D.; A. Darrow, Ph.D.; K. Hirokawa, M.D.; S. Howard, Ph.D.; D. Jin, Ph.D.; S. Kaul, Ph.D.; A. Kelekar, Ph.D.; D. Komma, Ph.D.; P. Lin, Ph.D.; J. Messina, Ph.D.; W. Meyer, Ph.D.; B. Mohanty, Ph.D.; S. Neece, Ph.D.; G. Pickett, Ph.D.; M. A. Reddy, Ph.D.; J. Romac, Ph.D.; T. Sahoo, M.D.; M. Saitta, M.D.; M. Starnes, Ph.D.; M. Underhill, Ph.D.

Emeritus Chairman: Wolfgang K. Joklik, D. Phil.

Required Courses

MIC-200. The core course in microbiology for medical students is given during the second semester of the first year. An intensive study is made of the common bacteria, viruses, fungi, and parasites that cause disease in man. The didactic portion of the course focuses on the fundamental biology of micro-organisms causing disease and the molecular mechanisms of the disease process. Attention is given to the host-parasite relationship and the role of the immune system and antimicrobial therapy on this interaction.

The laboratory portion of the course is designed to acquaint students with the basic microbiology techniques employed in the clinical microbiology laboratory, and to provide the basis for an understanding of cell-virus interactions. Medical case histories are presented by the clinical staff to correlate this course with patient care.

Electives

MIC-246B. Seminar on Parasitic Diseases. Topics in the physiology and immunology of major human and animal parasites with an emphasis on protozoa and schistosomes. Extensive reading in and discussion of current literature. Basic parasitology developed in introductory readings and lectures. C-L: Graduate School. Weight: 3 Min: 5. *Balber*

MIC-252B. General Virology and Viral Oncology. The first half of the course will be devoted to a discussion of the structure and replication of mammalian and bacterial viruses. The second half deals specifically with tumor viruses which are discussed in terms of the virus-cell interaction, the relationship of virus infection to neoplasia, and the application of retroviruses in molecular and developmental biology. Permission of the instructors is required. C-L: IMM 252B; Graduate School. Weight: 4 Min: 5. *Keene, Joklik, Bastia, Kreuzer, Ostrowski, Linney, Nevins, and Pickup*

MIC-259B. Molecular Biology I: Proteins and Enzymes. Detailed concepts of the structure and function of proteins as enzymes and as structural elements of cellular substructures including: protein primary structure and its determination, patterns of protein folding, mechanisms of enzyme catalysis and regulation, function and formation of multimeric

protein assemblies, proteins and other constituents of biological membranes. C-L: BCH 259B; CBI 259B; IMM 259B; Graduate School. Weight: 3. *Richardson and staff*

MIC-268B. Molecular Biology II: Nucleic Acids. Biochemistry of nucleic acids, with emphasis on their chemistry, structure, metabolism, and biological function in information transfer. Prerequisites: introductory biochemistry and Biochemistry 259. C-L: BCH 268B; IMM 268B; Graduate School. Weight: 4. *Bastia, Been, Greenleaf, Hsieh, Johnston, Modrich, and Steege*

MIC-269B. Advanced Cell Biology. An advanced course in cell biology with emphasis on current research literature and featuring in-depth discussion of selected areas by staff engaged in research in these areas. The course covers membrane structure and physiology, the cytoskeleton, cell motility systems, chromosome mechanics, chromosome structure and function, and eukaryotic gene structure, control, and replication. C-L: CBI 269B; IMM 269B; Graduate School. Weight: 3. *Nicklas and staff*

MIC-291B. Comprehensive Immunology. An intensive course in the biology of the immune system and the structure and function of its component parts. Major topics discussed are: properties of antigens; specificity of antibody molecules and their biologic functions; cells and organs of the lymphoid system; structure and function of complement; inflammation and nonspecific effector mechanisms; cellular interactions and soluble mediators in lymphocyte activation, replication, and differentiation; regulation of immune responses, neoplasia and the immune system; molecular structure and genetic organization of immunoglobulins, histocompatibility antigens, and T cell receptor. C-L: IMM 291B; Graduate School. Weight: 4: Max: 10. *Krangel and staff*

MIC-301B. Principles of Infectious Diseases. A seminar course to familiarize students with the basic biologic concepts, the pathogenesis and the clinical manifestations of infectious diseases caused by bacteria, viruses, fungi, rickettsia. The host defenses to infectious agents including the acute inflammatory response, humoral and cellular immunity, and current and future trends in the development of vaccines and antimicrobial and antiviral agents will also be discussed. Weight: 3 Min: 10. *Snedeker, Wilfert, Gutman, McKinney, and staff*

MIC-304B. Molecular Membrane Biology. Advanced seminar course on various cellular membranes; emphasis on cell biology of the immune system. Discussion topics include: biosynthesis of membrane proteins, intracellular transport vesicles, endocytosis, signal transduction across the plasma membrane, intracellular organelles and protein sorting, cell interactions in differentiation. Prerequisite: permission of instructor. C-L: IMM 304B; Graduate School. Weight: 2 Max: 16 Min: 10. *Argon*

MIC-308B. Clinical Microbiology—Immunology. A bench-training course in methods used in clinical microbiology stressing isolation and characterization of clinically significant microorganisms. Course conducted in the VA hospital microbiology laboratory. Prerequisites: Permission of instructor. Weight: 8 Max: 4. *Zwadyk*

MIC-310B. Molecular Development. Selected topics of current research using molecular and genetic approaches to study development and developmental gene regulation in eukaryotes. Lectures and student presentations of research with various developmental systems (e.g., *C. elegans*, *Drosophila*, mouse teratocarcinoma cells, mouse embryos) will be included. C-L: Graduate School. Weight: 2 Max: 10 Min: 5. *Linney*

MIC-325B. Medical Mycology. Comprehensive lecture and laboratory coverage of the fungi that are pathogenic for humans. The epidemiology, clinical manifestations, diagnosis, host responses, and treatment of each mycotic disease will be explored along with the biology, ecology, immunology, and mechanisms of pathogenicity of the fungal agents. Both practical aspects and future trends in clinical mycology as well as the dynamics of host-fungal

interactions will be covered. Several invited lecturers, each an internationally recognized scientist, will discuss his or her particular area of mycological expertise and current research. C-L: Graduate School. Weight: 4 Max: 10. *Mitchell*

MIC-330B. Medical Immunology. A brief review of basic concepts of immunology is followed by in-depth discussions of the role of immune mechanisms in the pathogenesis and treatment of human diseases. Principle emphasis is placed on immune deficiency diseases, hypersensitivity, alloimmunity, transplantation, infectious diseases, autoimmunity, tumor immunology, and immunohematology. When applicable the classes include patient presentations and laboratory demonstrations. C-L: IMM 330B; Graduate School. Weight: 5. *F. Ward and staff*

MIC-399B. Preceptorship in Microbiology. An individual reading and/or laboratory course in specialty areas supervised by an individual faculty member. Acceptance, nature of topic, and amount of credit by individual arrangement with proposed faculty member. Prerequisites: to be determined by instructor. Weight: 1-18. *Staff*

Neurobiology

Professor Dale Purves, M.D. (Harvard, 1964), *Chairman*.

Professors: Mohammed Abou-Donia, Ph.D. (California at Berkeley, 1967); Irving T. Diamond, Ph.D. (Chicago, 1952); Warren G. Hall, Ph.D. (Johns Hopkins, 1975); William C. Hall (Duke, 1967); David R. McClay, Ph.D. (North Carolina at Chapel Hill, 1971); James O. McNamara, M.D. (Michigan, 1968); Allen D. Roses, M.D. (Pennsylvania, 1967); Sidney A. Simon, Ph.D. (Northwestern, 1973); Theodore Slotkin, Ph.D. (Rochester, 1970); George G. Somjen, M.D. (Amsterdam, 1956); John Staddon, Ph.D. (Harvard, 1964).

Associate Professors: George Augustine, Ph.D. (Maryland, 1980); Nell B. Cant, Ph.D. (Michigan, 1973); John H. Casseday, Ph.D. (Indiana, 1970); Joseph M. Corless, M.D. (Duke, 1972), Ph.D. (Duke, 1971); Robert P. Erickson, Ph.D. (Brown, 1958); David Fitzpatrick, Ph.D. (Duke, 1982); Lawrence C. Katz, Ph.D. (California Instit. of Tech., 1984); William D. Matthew, Ph.D. (California at San Francisco, 1981); J. Victor Nadler, Ph.D. (Yale, 1972); Donald Schmechel, M.D. (Harvard, 1974); J. H. Pate Skene, Ph.D. (Washington Univ., 1980); E. Lee Tyrey, Ph.D. (Illinois, 1969); Myron L. Wolbarsht, Ph.D. (Johns Hopkins, 1958); Fulton Wong, Ph.D. (Rockefeller, 1977).

Assistant Professors: Robert R. H. Anholt, Ph.D. (California at San Diego, 1982); Robert T. Freneau, Jr., Ph.D. (George Washington, 1985); Julie A. Kauer, Ph.D. (Yale, 1986); Anthony S. LaMantia, Ph.D. (Yale, 1988); Darrell V. Lewis, M.D. (Minnesota, 1969); Donald Lo, Ph.D. (Yale, 1989); Stephen Nowicki, Ph.D. (Cornell, 1984); Peter H. Reinhart, Ph.D. (Australian National University, 1985); Dennis Turner, M.D. (Indiana, 1975).

Associate Research Professor: Michael L. Hines, Ph.D. (Chicago, 1975).

Assistant Research Professors: Ellen Covey, Ph.D. (Duke, 1980); Barbara J. Crain, M.D. (Duke, 1979), Ph.D. (Duke, 1978); Gillian Einstein, Ph.D. (Pennsylvania, 1984); Eric Javel, Ph.D. (Pittsburgh, 1972); Roger D. Madison, Ph.D. (Duke, 1981).

Professor Emeritus: John W. Moore, Ph.D. (Virginia, 1945); J. David Robertson, M.D. (Harvard, 1945), Ph.D. (Massachusetts Instit. of Tech., 1952).

Required Course

NBI-202. Basic Neurobiology. A systematic introduction to the structure and function of the mammalian nervous system designed specifically for first-year medical students. Lectures, laboratory exercises, clinical presentations and problem-solving conferences during the month of January. Weight: 4. *Purves and staff*

Electives

NBI-208B. Cellular Neurobiology. Basic principles of neural electrical activity. Areas of emphasis will include action potential generation, ion channel structure/function relationships, modulation of channel activity, neurotransmitter secretion, transmitter receptors and mechanisms of synaptic plasticity. Prerequisite: consent of instructors. C-L: Graduate School. Weight: 3 Max: 5. *Augustine, Kauer, and Reinhart*

NBI-209B. Systems Neurobiology. Structure and function of the mammalian sensory and motor systems. Prerequisite: consent of instructors. C-L: Graduate School. Weight: 3 Max: 5. *Cant and Fitzpatrick*

NBI-211B. Developmental Neurobiology. The development of the nervous system covering both the history and present status of the major issues in this field. Prerequisite: consent of instructors. C-L: Graduate School. Weight: 3 Max: 5. *Purves, Katz, and LaMantia*

NBI-212B. Molecular Neurobiology. The macromolecules responsible for the specialized functions of neurons and glia. Topics stress the biochemical, molecular, cellular and genetic processes involved in the development and function of the mammalian nervous system. Introductory biochemistry is recommended. Prerequisite: consent of instructors. C-L: Graduate School. Weight: 3 Max: 5. *Matthew, Skene, and Lo*

NBI-266B. Comparative Neurobiology. The evolution and functional organization of the vertebrate brain. A study of the original papers of the great pioneers in evolution, neuropsychology, and neuroanatomy. Prerequisite: consent of instructor. C-L: Graduate School. Weight: 3 Max: 5. *Diamond*

NBI-310B. Neurobiology of Disease. Diseases affecting the nervous system, such as Alzheimer's dementia, Duchenne muscular dystrophy, and myasthenia gravis. Description of the clinical manifestations of these diseases, and emphasis on how fundamental mechanisms of biosynthesis, organelle, and neural functions may be disrupted to produce nervous system dysfunction. Weight: 1 Min: 5. *Strittmatter, Turner, and staff*

NBI-320B. Neuroethology. The relation between brain function and natural behavior of animals. One or two topics will be examined during the semester, for example, echolocation by bats, electric communication by fish, celestial orientation by bees and birds, temporally patterned complex behaviors. Weight: 3 Max: 5. *Casseday*

NBI-399. Research in Neurobiology. Guided independent study and research experience in neurobiology. Nature of topic to be decided by individual arrangement with faculty advisor. Prerequisite: consent of faculty advisor. Weight: 1-18. *Staff*

Obstetrics and Gynecology

Professor: Charles B. Hammond, M.D., E. C. Hamblen Chair of Reproductive Biology and Family Planning, (Duke, 1961), *Chairman*.

Professors: W. Allen Addison, M.D. (Duke, 1960); Daniel L. Clarke-Pearson, M.D. (Case Western Reserve, 1975); Arthur F. Haney, M.D. (Arizona, 1972); William N. P. Herbert, M.D. (Bowman, Gray, 1972); Gale Hill, Ph.D. (Duke, 1966); Allen P. Killam, M.D. (Texas, 1960); Warren E. Patow, M.D. (Marquette, 1947); Charles H. Peete, Jr., M.D. (Harvard, 1947); David W. Schomberg, Ph.D. (Purdue, 1965); E. Lee Tyrey, Ph.D. (Illinois, 1969).

Associate Professors: Andrew Berchuck, M.D. (Case Western Reserve, 1980); Marvin L. Hage, M.D. (Michigan, 1967); Claude L. Hughes, M.D., Ph.D. (Duke, 1980); Helen Kay, M.D. (Yale, 1979); Charles H. Livengood III, M.D. (Duke, 1976); Lloyd F. Redick, M.D. (Ohio, 1958); Patricia M. Saling, Ph.D. (Pennsylvania, 1979); John T. Soper, M.D. (Iowa, 1978).

Associate Clinical Professor: Anna L. Stout, Ph.D. (South Carolina, 1980).

Assistant Professors: Nels C. Anderson, Ph.D. (Purdue, 1964); Kevin E. Bachus, M.D. (Colorado, 1984); Mark C. Bidwell, M.D. (Wright State, 1984); Matthew P. Boente, M.D. (Rush, 1986); James D. Bowie, M.D. (Oklahoma, 1967); Grace M. Couchman, M.D. (Colorado, 1985); Victoria T. Handa, M.D. (Pennsylvania, 1986); Barbara Hertzberg, M.D. (Duke, 1980); Matthew F. Kohler, M.D. (Duke, 1987); Elizabeth G. Livingston, M.D. (Duke, 1984); Joanne T. Piscitelli, M.D. (Duke, 1980); Gustavo C. Rodriguez, M.D. (Illinois, 1985); M. Chrystie Timmons, M.D. (North Carolina at Chapel Hill, 1975); Cosmas J. M. Van de Ven, M.D. (Univ. of Leiden, Netherlands, 1986); Rita Vileisis, M.D. (Northwestern, 1975); David K. Walmer, M.D., Ph.D. (North Carolina at Chapel Hill, 1983); J. Brice Weinberg, M.D. (Arkansas, 1969); Carolyn Wilson, M.D. (Med. Coll. of Virginia, 1987).

Assistant Research Professor: Jon R. Wiener, Ph.D. (Virginia, 1984).

Assistant Clinical Professors: Nancy L. Bossert, Ph.D. (Northwestern, 1987); Richard C. Dwane, M.D. (Georgetown, 1962); Stephen C. Gooding, M.D. (Bowman Gray, 1965); Mary Lee Lobach, M.D. (Vanderbilt, 1984); Deborah Webster-Clair, M.D. (Tufts, 1981).

Assistant Consulting Professors: James L. Allen, M.D. (Emory, 1965); Paul S. Andrews, M.D. (North Carolina at Chapel Hill, 1981); Arnold B. Barefoot, M.D. (North Carolina at Chapel Hill, 1982); Rudy W. Barker, M.D. (North Carolina at Chapel Hill, 1967); Mary K. Beckwith, M.D. (Iowa, 1982); Walker H. Campbell, M.D. (Med. Coll. of Virginia, 1963); Karen H. Clark, M.D. (Alabama, 1982); Vivian E. Clark, M.D. (Boston Univ., 1981); David B. Crosland, M.D. (North Carolina at Chapel Hill, 1958); Yancey G. Culton, Jr., M.D. (Duke, 1956); Jerry L. Danford, M.D. (Duke, 1967); Crowell T. Daniel, Jr., M.D. (Med. Coll. of Virginia, 1948); James R. Dingfelder, M.D. (Jefferson, 1965); Michael D. Fried, M.D. (New York, 1971); Carl A. Furr, Jr., M.D. (North Carolina at Chapel Hill, 1958); Francis S. Gardner, Jr., M.D. (Maryland, 1951); Michael D. Gooden, M.D. (North Carolina at Chapel Hill, 1973); Ronald E. Granger, M.D. (California at Irvine, 1977); William B. Gunter, Jr., M.D. (Emory, 1982); William D. Haithcock, M.D. (Med. Univ. of South Carolina, 1973); Joe W. Hardison, M.D. (North Carolina at Chapel Hill, 1965); Perry M. Harmon, M.D. (North Carolina at Chapel Hill, 1974); Charles O. Harris, M.D. (Duke, 1979); Bennet A. Hayes, M.D. (North Carolina at Chapel Hill, 1957); Melvin L. Henderson, M.D. (Duke, 1978); Wanda L. Jenkins, M.D. (Cincinnati, 1979); Clayton J. Jones, M.D. (Tennessee, 1952); Johnnie E. Jones, M.D. (Meharry, 1976); Glenward T. Keeney, M.D. (Med. Coll. of Virginia, 1967); William R. Lambeth, M.D. (Bowman Gray, 1974); John W. Lane, M.D. (Duke, 1972); Richard E. Lassiter, M.D. (North Carolina at Chapel Hill, 1965); Stephen C. Lies, M.D. (Duke, 1976); Frank E. Long, M.D. (Maryland, 1975); Jack P. McDaniel, M.D. (North Carolina at Chapel Hill, 1956); Dudley C. Miller, M.D. (Missouri, 1959); James P. Moon, M.D. (South Dakota, 1979); William A. Nebel, M.D., (North Carolina at Chapel Hill, 1962); Talbot F. Parker, Jr., M.D. (Jefferson, 1951); Phillip H. Pearce, M.D. (Duke, 1960); Marla M. Presta, M.D. (Chicago, 1982); Steven M. Scott, M.D. (Indiana, 1974); E. Frank Shavender, M.D. (North Carolina at Chapel Hill, 1968); W. Siegfried Smith, Jr., M.D. (Duke, 1961); Thomas A. Stokes, M.D. (Duke, 1955); Allen H. Van Dyke, Jr., M.D. (Bowman Gray, 1971); Paul A. Vieta, M.D. (New Jersey, 1966); Bertram E. Walls, M.D. (Duke, 1972); Robert K. Yowell, M.D. (Duke, 1961).

Research Associates: Deborah Burke, Ph.D. (Vanderbilt, 1990); Lisette Leyton, Ph.D. (University of Chile, 1989); Claudia Tomez, Ph.D. (Universidad de Buenos Aires, 1991).

Associates: Patrick Blohm, M.D. (Rush, 1988); Jean Hurteau, M.D. (University of Montreal, 1985); Cyrus McCalla, M.D. (New York at Brooklyn, 1988); Evan R. Myers, M.D. (Pennsylvania, 1988); Cynthia Shellhaas, M.D. (Northeastern Ohio, 1988); Sharon L. Rupp, B.S., A.A.S.

Clinical Associates: Elizabeth J. Burkett, B.S.N., M.S.N.; Lorraine Fry-Mehlretter, M.S.

Consulting Associates: Avis A. Artis, M.D. (Duke, 1984); Linda K. Bresnahan, M.D. (Indiana, 1987); Pat C. Bryan, M.D. (North Carolina at Chapel Hill, 1983); Christie L. Clayton, M.D. (East Carolina, 1986); Cathryn L. Crosland, M.D. (Kentucky, 1983); Gerianne Geszler, M.D. (Duke, 1985); Daniel L. Gottsegen, M.D. (Tufts, 1969); Stuart H. Jordan, M.D. (North Carolina at Chapel Hill, 1985); Glen A. Nowachek, M.D. (Loyola, 1982); Russel F. Palmeri, M.D. (Georgetown, 1980); Kathy A. Santoriello, M.D. (Duke, 1984); Ira Q. Smith, M.D. (Bowman Gray, 1979).

Required Course

In Introduction to Clinical Medicine the first-year student receives instruction in the fundamentals of obstetric and gynecologic history and pelvic examinations.

OBG-205C. Required of all second-year students—consists of eight weeks in general obstetrics and gynecology. Students attend lectures, work daily in the general and special outpatient clinics, and are assigned patients on the obstetric and gynecologic wards. Students share in patient care, teaching exercises, and in daily tutorial sessions with the faculty. Clinical conferences, a gynecologic-pathology conference, endocrine conferences, and correlative seminars and lectures are included.

Electives

OBG-210C. Gynecologic Cancer. This course presents a clinical experience in the management of patients with a gynecologic malignancy. The student will assume the role of an extern. Outpatient, inpatient, and operative exposure to these patients will be extensive. Weight: 4 or 8 Max: 1. *Clarke-Pearson, Soper, Berchuck, and Rodriquez*

OBG-213C. Preparation for Practice, Cape Fear Valley Hospital, Fayetteville AHEC. This is a unique opportunity to receive both didactic exposure and clinical experience in obstetrics and gynecology in Cape Fear Valley Hospital, a large community hospital in Fayetteville, North Carolina, where almost 4,000 patients are delivered each year. A student will actively participate in the care of patients in the labor and delivery room, assist at surgery, and render postoperative care. This is a community hospital experience rather heavily weighted in clinical obstetrics. Students will be exposed to a large volume of clinic opportunities. Three senior residents from Duke rotate through Cape Fear Valley Hospital. The

students will be directly supervised by Dr. Warren Patow (full-time Duke faculty at Cape Fear), in addition to Duke Ob-Gyn residents. Prerequisites: permission of Dr. Hammond prior to signing for the course. Check availability through Dr. Patow's office. Weight: 4 Max: 1. *Hammond, Patow, Gooding, and staff of Cape Fear Valley Hospital*

OBG-231C. Clinical Reproductive Endocrinology. Course for students who desire additional basic and clinical experience in examination, diagnosis, and treatment of obstetric and gynecologic patients with endocrinopathy and infertility. Course consists of instruction in clinical reproductive problems correlated with examination and treatment of patients both in the Endocrinology Outpatient Clinic and in the hospital. Permission of instructor required. Weight: 4 Max: 1. *C. Hughes, Haney, Hammond, Walmer, Bachus, and reproductive endocrinology fellows*

OBG-239C. Perinatal Medicine. A study of the relationship of clinical factors during pregnancy, labor, delivery, and the first month of life. Emphasis will be placed on abnormal conditions of pregnancy as related to the infant, prenatal pathological conditions adversely affecting the fetus and the newborn, and early management of the infant. Current problems in the maternal-fetal relationships will be outlined. The clinical rotation will consist of half-time on the high risk obstetric service and half on the nursery service. Duke North ICN or Duke North Nurseries. See also PED 225C. Prerequisites: must contact Dr. Herbert prior to registration. Weight: 8 Max: 2. *Herbert*

OBG-243C. Human Sexuality. This is an opportunity for all medical students to become more comfortable with talking about sexual issues. Students will act as discussion group leaders for a Duke undergraduate course in human sexuality. Discussion facilitation rather than didactic teaching is emphasized. Weight: 1 Max: 30. *Stout*

OBG-245C. Office Gynecology. For students preparing for non ob-gyn careers. Outpatient clinic diagnosis and patient care are taught. Weight: 4 or 8 Max: 2. *Dwane and staff*

OBG-247C. Clinical Obstetrics. For students preparing for general practice of medicine, pediatrics, or obstetrics and gynecology. This course will study the relationship of clinical factors during pregnancy, labor, and delivery. Emphasis will be placed on abnormal conditions of pregnancy as related to the infant. Current problems in the maternal-fetal relationship will be outlined. The student will function on an intern level and take part in activities of the housestaff and faculty. Weight: 5 or 10 Max: 2. *Herbert, Killam, Hage, Kay, Livingston, and fellows on obstetrical service*

OBG-249C. Clinical Gynecology. For students preparing for obstetrics and gynecology, general practice, surgery, and urology. Emphasis is placed on the outpatient assessment of patients with acute and chronic gynecologic disorders including benign neoplasia, loss of pelvic support, menopausal symptomatology, and others. Students will have the opportunity to work closely with faculty members in the Division of Gynecology. Inpatient care is not required, but participation in the operative care of gynecologic patients can be arranged if desired. Ample time for independent study is planned. It is anticipated that the student will utilize this time reviewing a specific clinical problem with frequent guidance and input from a member of the Gynecology Division with similar interests. Weight: 4 or 8 Max: 1. *Addison, Peete, Livengood, Piscitelli, and Timmons*

OBG-253C. Preparation for Practice, Cabarrus Memorial Hospital, Concord, North Carolina. This is an opportunity to receive both didactic exposure and clinical exposure in obstetrics and gynecology in the community hospital. The student will be expected to function as an intern. The student will participate actively in the care of the patients in the labor and delivery area, assist at surgery, and render postpartum and postoperative care. This is a community hospital experience rather heavily weighted in clinical obstetrics. The student will be exposed to a large volume of clinical material. The

practitioners in the community are all board certified obstetricians and gynecologists and are interested in student teaching. A Duke faculty person will provide additional guidance by visits once per week. This elective can be taken for four weeks for four units or eight weeks for eight units. The students will be housed in quarters available for them. Prerequisites: permission of Dr. Livengood prior to signing for the course. Weight: 4, 6, or 8 Max: 1. *Livengood and staff of the Cabarrus Memorial Hospital*

Ophthalmology

Professor: David L. Epstein, M.D. (Johns Hopkins, 1968), *Chairman*.

Professors: W. Banks Anderson, Jr., M.D. (Harvard, 1956); Gary N. Foulks, M.D. (Columbia, 1970); Diane Van Horn Hatchell, Ph.D. (Marquette, 1968); Joseph A. C. Wadsworth Research Professor of Ophthalmology Gordon K. Klintworth, M.D. (Univ. of Witwatersrand, 1957), Ph.D. (Univ. of Witwatersrand, 1966); Helena Rubinstein Foundation Professor of Ophthalmology Robert Machemer, M.D. (Freiburg, Germany, 1959); Brooks W. McCuen II, M.D. (Columbia, 1974); M. Bruce Shields, M.D. (Oklahoma, 1966).

Associate Professors: Edward G. Buckley, M.D. (Duke, 1977); Jonathan G. Dutton, M.D. (Washington, 1977); Judy H. Seaber, Ph.D. (Duke, 1985); Fulton Wong, Ph.D. (Rockefeller, 1977).

Assistant Professors: Craig Fowler, M.D. (Med. Coll. of Virginia, 1985); Glenn J. Jaffe, M.D. (California at San Francisco, 1983); Stephen C. Pollock, M.D. (Illinois, 1981); Alan D. Proia, Ph.D. (Rockefeller, 1979), M.D. (Cornell, 1980).

Assistant Clinical Professor: Calvin H. Mitchell, M.D. (Duke, 1958).

Assistant Research Professor: E. Timothy O'Brien, Ph.D. (California at Santa Barbara, 1986).

Associate Consulting Professors: Edward K. Isbey, Jr., M.D. (Michigan, 1955); Lawrence W. Moore, Jr., M.D. (Duke, 1963).

Assistant Consulting Professors: David P. Berry, M.D. (South Carolina, 1975); John E. Bourgeois, M.D. (Virginia, 1979); David J. Browning, M.D. (Duke, 1981) Ph.D. (Duke, 1980); Anne Marie Hanneken, M.D. (Med. Coll. of Wisconsin, 1984); Edward K. Isbey III, M.D. (North Carolina at Chapel Hill, 1981); Jeremiah R. Marion, M.D. (Duke, 1975); Walter C. McLean, Jr., M.D. (Virginia 1975); Charles F. Sydnor, M.D. (Virginia, 1969).

Consulting Associates: Thomas L. Beardsley, M.D. (Duke, 1971); J. Thomas Foster, M.D. (Duke, 1958); William R. Harris, M.D. (North Carolina at Chapel Hill, 1956); Ann Kathryn Joslyn, M.D. (Duke, 1983); John H. Killian, M.D. (Bowman Gray, 1967); Martin J. Kreshon, M.D. (Marquette, 1954); W. Hampton Lefler, M.D. (Bowman Gray, 1963); Harold E. Shaw, Jr., M.D. (Med. Univ. of South Carolina, 1973); Robert E. Wiggins, M.D. (North Carolina at Chapel Hill, 1984).

Emeritus: Joseph A. C. Wadsworth, M.D.

Electives

OPH-210C. Medical Ophthalmology. The ophthalmic signs and symptoms of systemic disease are presented in a lecture series. Oriented for those students interested primarily in pediatrics, internal medicine, or ophthalmology. If permitted by the instructor, this clinical science course can be audited. Weight: 1 Min: 6 Max: 20. *Shields and Mitchell*

OPH-212C. General Ophthalmology. A clinical preceptorship in which the student will participate and observe the regular house staff activities, conferences, lectures, patient care, and treatment including surgery. Emphasis on the use of specialized ophthalmic apparatus is emphasized. Prerequisites: OPH 210C recommended, but not required. Weight: 4 or 8 Max: 2. *Shields*

OPH-213C. Ophthalmic Pathology. The student will review all ophthalmic pathology specimens submitted and any pertinent permanent specimens. He or she will attend all regular ongoing ophthalmic pathology conferences. Prerequisites: OPH 212C and OPH 210C recommended, but not required. Not available in summer. Weight: 1. *Klintworth and Proia*

OPH-214C. Investigative Ophthalmology. The student is assigned a project relating to basic ophthalmologic problems. Technical assistance, sufficient equipment, and laboratory animals are supplied for the completion of the project. The student is expected to attend all scheduled research seminars. Prerequisites: OPH 212C and OPH 210C suggested, but not required. Student must devote at least three months to the elective. Weight: 4 or 8 Max: 2. *Klintworth, Hatchell, Wong, Proia, Jaffe, and Epstein*

OPH-215C. Pediatric Ophthalmology. A clinical preceptorship in which the student will participate in an outpatient pediatric ophthalmology clinic. The student will encounter the more common ocular disorders of childhood including ocular motility disturbances, congenital disorders, and congenital metabolic disorders. The diagnosis and treatment aspects will be emphasized heavily. The course meets on Tuesdays or Thursdays from 9:00 a.m. till 4:00 p.m. or by special arrangement, such as 1/2 day Tuesday and 1/2 day Thursday. Additional experiences, which would include surgery and/or pediatric neuro-ophthalmology, can be arranged. Weight: 1 or 2 Max: 3. *Buckley and Seaber*

OPH-216C. Clinical Neuro-Ophthalmology. An advanced clinical preceptorship that provides students with exposure to a variety of neuro-ophthalmologic problems, including diseases affecting the optic nerve and central visual pathways and disorders of eye movement. Emphasis is placed on history taking, acquisition of specialized examination techniques (visual fields, pupils, ocular motility and fundus), and the logical analysis of clinical information. The course meets one day per week, either on Tuesday or Thursday and begins at 8:30 A.M. Prerequisites: OPH 212C. Weight: 1 Max: 1. *Pollock*

Pathology

Professor: Salvatore Pizzo, M.D. (Duke, 1972), Ph.D. (Duke, 1973), *Chairman*.

Professors: Dolph O. Adams, M.D. (Med. Coll. of Georgia, 1965); Ph.D. (North Carolina at Chapel Hill, 1969); Darel D. Bigner, M.D. (Duke, 1965), Ph.D. (Duke, 1971); Sandra H. Bigner, M.D. (Tennessee, 1971); Edward H. Bossen, M.D. (Duke, 1965); William D. Bradford, M.D. (Western Reserve, 1958); Peter C. Burger, M.D. (Northwestern, 1966); Doyle G. Graham, M.D. (Duke, 1966), Ph.D. (Duke, 1971); Raymond E. Ideker, M.D. (Tennessee, 1974), Ph.D. (Tennessee, 1972); James B. Duke Professor Robert B. Jennings, M.D. (Northwestern, 1950); William W. Johnston, M.D. (Duke, 1959); Gordon K. Klintworth, M.D. (Univ. of Witwatersrand, 1957), Ph.D. (Univ. of Witwatersrand, South Africa, 1966); John A. Koepke, M.D. (Wisconsin, 1956); Keith A. Reimer, M.D. (Northwestern, 1972); L. Barth Reller, M.D. (Virginia, 1966); Conrad Richter, V.M.D. (Pennsylvania, 1959); Stanley J. Robboy, M.D. (California at Los Angeles, 1965); Alfred Sanfilippo, Ph.D. (Duke, 1975), M.D. (Duke, 1976); Kenneth A. Schneider, M.D. (Northwestern, 1959); John D. Shelburne, M.D., (Duke, 1972), Ph.D. (Duke, 1971); Joachin R. Sommer, M.D. (Munich, 1951); Benjamin Wittels, M.D. (Minnesota, 1952).

Adjunct Professor: Paul Nettesheim, M.D., D.M.S. (Bonn, West Germany, 1959).

Associate Professors: Michael J. Borowitz, M.D., Ph.D. (Duke, 1977); James D. Crapo, M.D. (Rochester, 1971); Lester Layfield, M.D. (California at Los Angeles, 1979); Kenneth S. McCarty, Jr., M.D. (Duke, 1972), Ph.D. (Duke, 1973); Alan D. Proia, M.D. (Cornell, 1980), Ph.D. (Rockefeller, 1979); Victor L. Roggli, M.D. (Baylor, 1976); John Toffaletti, Ph.D. (North Carolina at Chapel Hill, 1977); Frances King Widmann, M.D. (Case Western Reserve, 1960); Peter Zwadyk, Jr., Ph.D. (Iowa, 1971).

Clinical Associate Professor: Emily A. G. Reisner, Ph.D. (Case Western, 1969).

Adjunct Associate Professor: James A. Swenberg, D.V.M. (Minnesota, 1966), Ph.D. (Ohio, 1970).

Assistant Professors: Surinder Kumar Batra, Ph.D. (NDRI, Karnal, 1982); Steven J. Bredehoeft, M.D. (Kansas, 1974); Mark W. Dewhirst, D.V.M. (Colorado State, 1975), Ph.D. (Colorado State, 1979); Jan Enghild, Ph.D. (Univ. of Aarhus, Denmark, 1987); Henry S. Friedman, M.D. (New York at Syracuse, 1977); Marcia Gottfried, M.D. (Northwestern, 1978); Charles S. Greenburg, M.D. (Hahnemann, 1976); John M. Harrelson, M.D. (Duke, 1965); Maureane Hoffman, M.D. (Iowa, 1982), Ph.D. (Iowa, 1982); David Howell, M.D. (Duke, 1984), Ph.D. (Duke, 1982); Christine M. Hulette, M.D. (Louisville, 1983); Peter D. Issitt, Ph.D. (Columbia Pacific, 1987); Randy H. Jirtle, Ph.D. (Wisconsin, 1976); Hideko Kamino, M.D. (Med. Autonomous Univ. of Mexico, 1969); William Kane, M.D., Ph.D. (Washington Univ., 1982); Joanne Kurtzberg, M.D. (New York Med. Coll. 1976); Richard M. Levenson, M.D. (Michigan, 1979); James G. Lewis, Ph.D. (Duke, 1982); James E. Lowe, M.D. (California at Los Angeles, 1973); Kim Lyerly, M.D. (California at Los Angeles, 1983); Gail Macik, M.D. (Texas Health Sciences Center, 1983); Roger C. McLendon, M.D. (Med. Coll. of Georgia, 1982); Sara Miller, Ph.D. (Georgia, 1982); L. Darryl Quarles, M.D. (Alabama, 1979); Howard Ratech, M.D. (Albany Med. Coll., 1976); Guy S. Salveson, Ph.D. (Cambridge Univ., 1980); David Sane, M.D. (Duke, 1983); Jonathan I. Scheinman, M.D. (Illinois, 1966); Daniel I. Schenkman, D.V.M. (Purdue, 1979), Ph.D. (Wisconsin, 1986); Charles Steenbergen, M.D. (Pennsylvania, 1978), Ph.D. (Pennsylvania, 1979); Marilyn Telen, M.D. (New York Univ., 1977); Philip J. Walther, M.D. (Duke, 1975), Ph.D. (Duke, 1974); Mary Kay Washington, M.D. (North Carolina at Chapel Hill, 1986); Michael R. Zalutsky, Ph.D. (Washington Univ., 1974).

Assistant Clinical Professors: John A. Bittikofer, Ph.D. (Purdue, 1971); Linda Ann Ryan Charles, Ph.D. (North Carolina at Chapel Hill, 1990); Barbara J. Crain, M.D., Ph.D. (Duke, 1979); Jane Gaede, M.D. (Duke, 1966); Robert B. Kinney, M.D. (Duke, 1981); Frank A. Sedor, Ph.D. (Florida, 1971); Robin T. Vollmer, M.D. (Duke, 1967).

Assistant Research Professors: Venkataraman Amarnath, Ph.D. (Carnegie-Mellon, 1973); Gerald E. Archer, Jr., Ph.D. (Cincinnati, 1987); Steven S. Geier, Ph.D. (Duke, 1978); Mario Gonzalez-Gronow, D.Sc.

(Chile, 1970); Stewart Johnson, Ph.D. (Case Western Reserve, 1983); B. K. Ahmed Rasheed, Ph.D. (Indian Instit. of Science, India, 1981); Sharon Stack, Ph.D. (Louisville, 1989); William M. Valentine, Ph.D. (Illinois at Chicago, 1983), D.V.M. (Illinois at Urbana, 1985).

Associate Research Professors: William M. Baldwin III, Ph.D. (Carnegie Mellon, 1973); Carol W. Lewis, Ph.D. (North Carolina at Chapel Hill, 1972).

Adjunct Assistant Professors: Arnold R. Brody, Ph.D. (Colorado, 1969); John Butts, M.D. (Duke, 1972); Thomas B. Clark III, M.D. (Med. Univ. of South Carolina, 1983); Lynn Crook, Ph.D. (Emory, 1966), M.D. (Med. Univ. of South Carolina, 1974); Peter Ingram, Ph.D. (Univ. of Southampton, England, 1967); Myla Lai-Goldman, M.D. (Columbia, 1983); Ralph C. McCoy, M.D. (Emory, 1967); James Alan Popp, D.V.M. (Ohio State, 1968), Ph.D. (California at Los Angeles, 1972); Jerry E. Squires, Ph.D. (Yale, 1971), M.D. (West Virginia, 1974).

Associates: Kenneth R. Broda, Ph.D. (Duke, 1977); Margaret C. Schmidt, M.A. (Louisville, 1969), Ed.D. (Duke, 1988).

Emeritus: Jane G. Elchlepp, M.D. (Chicago, 1955), Ph.D. (Iowa, 1948); Bernard F. Fetter, M.D. (Duke, 1944); Donald D. Hackel, M.D. (Harvard, 1946); Phillip C. Pratt, M.D. (Johns Hopkins, 1944); F. Stephen Vogel, M.D. (Western Reserve, 1944).

Required Course

PTH-200. The core course in pathology is given during the second term of the first year. Fundamentals of pathology are presented by correlating gross and microscopic material to illustrate the structural changes in disease. Lectures dealing with broad concepts of disease processes are presented by senior faculty, and conferences with small groups of students are held under the guidance of staff members. Etiology and pathogenesis of disease, as well as the experimental approach are emphasized for the purpose of correlation with clinical disease. In addition to group work, conferences are scheduled to discuss problems derived from autopsies. Students are required to collaborate in postmortem studies and present cases in clinical-pathologic conferences under the direction of the staff.

Electives

PTH-223B. Autopsy Pathology. The course is intended to introduce students to the autopsy as an investigative tool. Anatomic-clinical correlation is emphasized. Students work directly with one or more members of the Pathology Department. They will first assist at autopsies and then perform autopsies under supervision. They will work up these cases with particular attention to correlations with clinical and experimental medicine, prepare the final autopsy reports, and work essentially at the level of a house officer. Students will be expected to present their findings at staff conferences. Preference given to Pathology Study Program students. Weight: 8 Max: 3. *Proia*

PTH-225B. Cardiovascular Pathology. The anatomic and pathophysiologic basis of cardiovascular disease will be covered through lectures, workshops, laboratory study of preserved hearts and case material, and student seminars. Subject matter includes congenital heart disease (prefaced by normal cardiac anatomy and embryology), basis of cardiac dysrhythmias, ischemic heart disease and the effects of interventional therapy, valvular heart disease, cardiomyopathies, cardiac transplantation, and tumors. Weight: 2 Min: 8 Max 32. *Reimer, Steenbergen, Ideker, Vander Heide, and Jennings*

PTH-231B. Ophthalmic Pathology. This course is designed for students with an interest in ophthalmic diseases, particularly for those planning a career in pathology or ophthalmology and will consist of lectures, seminars, and laboratory sessions. The normal anatomy and embryology of the eye will be reviewed and the various reactions of the eye to injury will be studied in gross and microscopic specimens. The more common diseases will be considered in detail. Weight: 3 Min: 5. *Klintworth*

PTH-241B. Pathologic Basis of Clinical Medicine. This is a lecture course stressing clinicopathologic correlation, morphologic diagnosis, pathophysiology, and laboratory medicine. It is required for students enrolled in the Pathology Study Program, but will be available as a separate elective for all students. Lectures are on Thursday 8:00 - 9:30 am and

Friday 12:00 - 1:00 pm. Course must be taken for the entire year. No audits will be allowed. Weight: 1. *Bradford, Reimer, and Crain*

PTH-281B. Cytopathology Preceptorship. This course consists of full-time rotation in the diagnostic cytopathology laboratories. By working with the laboratory staff, the student will explore in detail the role played by diagnostic cytopathology in the diagnosis of disease. In addition to general cytology, the student will have the opportunity to participate in the fine needle aspiration biopsy service. Although not a requirement, the student will be encouraged to pursue special research projects. Preference given to Pathology Study Program students. Weight: 8 Max: 1. *Johnston, Bigner, Layfield, and cytopathology staff*

PTH-321B. Hormone and Tissue Interactions in Differentiation and Disease. Hormones and other biochemical signals involved in the regulation of the differentiated state including amino acids, polypeptide, and steroid hormone response through higher vertebrates will be discussed in terms of the new biotechnology used to elucidate mechanisms of information transfer and gene control at the level of the chromatin. Cell-cell, cell-matrix, and hormonal interactions will be considered as control elements in development and differentiation. Interactions involving the cell surface, the basal lamina, and extracellular matrix will be discussed in terms of differentiation of limb bud/pancreas/lymphocyte/and neural tissue. Conferences will include hormone control of sex differentiation, ectopic hormone biosynthesis, and endocrine related diseases. The course is designed as an extension of the course Differentiation in Development and Disease. C-L: BCH 321B; CBI 321B. Weight: 2 Max: 5. *K. McCarty Sr., B. Kaufman, and K. McCarty Jr.*

PTH-342B. Special Topics in Pathology. Special problems in pathology will be studied with a member of the senior staff. The subject matter will be individually arranged. Permission of the instructor required. Weight: 1-18. *Pizzo and staff*

PTH-346B. Subcellular and Molecular Pathology. This course is designed for students wishing to broaden their knowledge of cellular structure and cellular pathology. A series of lectures and seminars will be presented on the alterations in cellular structure and associated function that accompany cell injury. Ultrastructural changes in selected human diseases will be discussed in detail with emphasis on diagnosis and pathogenesis. Weight: 2. *Shelburne, Jennings, Sommer, Steenbergen, and Crain*

PTH-348B. Practical Surgical Pathology. This course will be in the form of an apprenticeship in which the student will work closely with residents in the actual preparation and diagnosis of tissue changes. Microscope required (limited number available on loan). Prerequisites: permission of instructor. Preference given to Pathology Study Program students. Weight: 8 Max: 2. *Robboy and staff*

PTH-353B. Neuropathology. A view of neuropathology that emphasizes clinicopathologic correlation. Weight: 3. *Burger and staff*

PTH-359B. Fundamentals of Electron Microscopy. Emphasis will be placed on the theory and application of electron microscopy to ultrastructural pathology. The methods relating to electron microscopy as well as x-ray microanalysis, ion microscopy, and immunocytochemistry will be considered. Lab experience is included. Weight: 3. *Shelburne, Sommer, Ingram, and LeFurgey*

PTH-364B. Skeletal Pathology. An overview of skeletal pathology beginning with the development of normal skeleton. A systemic review of inflammatory, neoplastic, metabolic, arthritic, vascular, dysplastic, and traumatic diseases of the skeleton. Weight: 2 Min 4 Max: 32. *Harrelson*

PTH-366B. Pulmonary Pathology and Pathophysiology. Emphasis will be on pulmonary pathology and pathophysiology of infections, metabolic, environmental, neoplastic

diseases, and certain diseases of unknown etiology (sarcoid, alveolar proteinosis, e.g.).
Weight: 3 Min: 2 Max: 15. *Roggli*

PTH-378B. Seminars in Hematology. This is a systematic survey of the pathophysiology and morphology of human hematological diseases. Each student will survey the literature on several topics and prepare an oral presentation which will be critically discussed by the group. Opportunity for experience in blood marrows and lymph node analysis will be available. Weight: 2 Min: 4 Max: 6. *Wittels*

PTH-380B. Surgical Pathology—Emphasis: Electron Microscopy. This course will be in the form of an apprenticeship in which the student will become engaged in the actual preparation and diagnosis of tissue changes using both light and electron microscopy. The student will of necessity learn how to operate the electron microscope. Prerequisites: PTH 359B suggested, but not required. Permission of instructor is required. Weight: 8 Max: 1. *Shelburne and Vollmer*

Pediatrics

Samuel L. Katz Professor Michael M. Frank, M.D. (Harvard, 1960), *Chairman*.

Professors: Page A. W. Anderson, M.D. (Duke, 1963); James B. Sidbury Professor Rebecca H. Buckley, M.D. (North Carolina at Chapel Hill, 1958); John M. Falletta, M.D. (Kansas, 1966); Henry S. Friedman, M.D. (New York at Syracuse, 1988); Thomas E. Frothingham, M.D. (Harvard, 1951); Arthur Garson, M.D. (Duke, 1974), M.P.H. (Texas at Houston, 1992); Herman Grossman, M.D. (Columbia, 1953); Wilburt C. Davison Professor Samuel L. Katz, M.D. (Harvard, 1952); Thomas R. Kinney, M.D. (Duke, 1970); Keith T. Oldham, M.D. (Med. Coll. of Virginia, 1976); Jeffrey L. Platt, M.D. (Southern California, 1977); Charles R. Roe, M.D. (Duke, 1964); A. Rebecca Snider, M.D. (Med. Univ. of South Carolina, 1974); James B. Duke Professor Madison S. Spach, M.D. (Duke, 1954); Alexander Spock, M.D. (Maryland, 1955); Catherine M. Wilfert, M.D. (Harvard, 1962).

Associate Professors: Brenda E. Armstrong, M.D. (St. Louis, 1974); Roger C. Barr, Ph.D. (Duke, 1968); Y. T. Chen, M.D., Ph.D. (Taiwan Univ., 1973); G. Robert DeLong, M.D. (Harvard, 1961); Peter C. English, M.D., Ph.D. (Duke, 1975); Michael S. Freemark, M.D. (Duke, 1976); William J. Greeley, M.D. (Texas at Houston, 1976); Laura T. Gutman, M.D. (Stanford, 1962); Allen P. Killam, M.D. (Texas at Galveston, 1960); Lowell R. King, M.D. (Johns Hopkins, 1956); Joanne Kurtzberg, M.D. (New York Med. Coll., 1976); Darrell V. Lewis, Jr., M.D. (Minnesota, 1969); John G. Looney, M.D. (Texas, Southwestern, 1969); Jonathan I. Scheinman, M.D. (Illinois, 1966); Raymond A. Sturner, M.D. (Georgetown, 1968).

Assistant Professors: Richard Auten, M.D. (North Carolina at Chapel Hill, 1981); A. Resai Bengur, M.D. (Med. Univ. of South Carolina, 1982); Edmond C. Bloch, M.B. (Univ. of Cape Town, South Africa, 1946); Rose-Mary Boustany, M.D. (Amer. Univ. of Beirut, Lebanon, 1979); William D. Bradford, M.D. (Western Reserve, 1958); Iley B. Browning III, M.D. (North Carolina at Chapel Hill, 1982); Edward G. Buckley, M.D. (Duke, 1977); Sara Chaffee, M.D. (Dartmouth, 1980); Dennis A. Clements, M.D. (Rochester, 1973), M.P.H. (North Carolina at Chapel Hill, 1988), Ph.D. (North Carolina at Chapel Hill, 1990); Kimberly Dunsmore, M.D. (Emory, 1985); Jeannine L. Gingras, M.D. (Vermont, 1978); Ricki F. Goldstein, M.D. (Cornell, 1981); Michael Graham, M.D. (Brown, 1975); A. Kimberly Iafolla, M.D. (Pittsburgh, 1984); J. David Jones, M.D. (Duke, 1954); Ronald J. Kanter, M.D. (Vanderbilt, 1979); Frank Kern, M.D. (Pennsylvania, 1982); J. Marc Majure, M.D. (Mississippi, 1981); M. Louise Markert, M.D., Ph.D. (Duke, 1982); Ross E. McKinney, Jr., M.D. (Rochester, 1979); Jon N. Meliones, M.D. (Tufts, 1984); Karen J. O'Donnell, Ph.D. (North Carolina at Chapel Hill, 1983); Martin P. O'Laughlin, M.D. (Columbia, 1980); Janice Olson, M.D. (Utah, 1985); Aglaia N. O'Quinn, M.D. (Duke, 1965); Shirley K. Osterhout, M.D. (Duke, 1957); Neil Prose, M.D. (New York, 1975); Linda L. Riordan, M.D. (New York, 1983); M. Henderson Rourke, Jr., M.D. (Pennsylvania, 1963); Scott Schulman, M.D. (George Washington, 1982); Jeffrey D. Snedeker, M.D. (Wisconsin, 1982); Robert H. Sprinkle, M.D. (Cincinnati, 1975), Ph.D. (Princeton, 1990); Deborah L. Squire, M.D. (Northwestern, 1978); Carl Stafstrom, M.D., Ph.D. (Washington, 1985); J. Gordon Still, M.D. (Bowman Gray, 1978), Ph.D. (Wake Forest, 1978); David T. H. Tanaka, M.D. (Johns Hopkins, 1979); Robert J. Thompson, Jr., Ph.D. (North Dakota, 1971); Kathryn Thrailkill, M.D. (Ohio State, 1983); Marjorie E. Tripp, M.D. (Yale, 1973); Ross M. Ungerleider, M.D. (Rush, 1977); Mary E. L. Vernon, M.D. (Columbia, 1976); Russell E. Ware, M.D. (Duke, 1983), Ph.D. (Duke, 1991); Richard J. Wenstrup, M.D. (Cincinnati, 1978); Delbert R. Wigfall, M.D. (Emory, 1979); Larry Williams, M.D. (Duke, 1977); Gordon Worley, M.D. (Harvard, 1973).

Associates: Jeffrey Baker, M.D. (Duke, 1984); Robert P. Drucker, M.D. (Duke, 1979); Dorothy B. Eisenberg, M.D. (Duke, 1985); Robert D. Fitch, M.D. (Duke, 1976); John Fowlkes, M.D. (Texas at San Antonio, 1985); Terry O. Harville, M.D. (Florida, 1986), Ph.D. (Florida, 1982); Sandra Hosford, M.D. (Duke, 1986); Jennifer Kempe-Biermann, M.D. (Colorado, 1988); Leslie Lehmann, M.D. (Duke, 1985); Roxanne Marcille, M.D. (Med. Univ. of South Carolina, 1980); Kathy A. Merritt, M.D. (Duke, 1985); Catharine Moffitt, M.D. (South Florida, 1988); John W. Moses, Jr., M.D. (South Carolina, 1983); C. D. Egl

Rabinovich, M.D. (Southern Illinois, 1985); Laura Schanberg, M.D. (Duke, 1984); Karen K. St. Claire, M.D. (Texas at Galveston, 1982); Emmanuel B. Walter, M.D. (Maryland, 1983).

Clinical Professors: Norman S. Talner, M.D. (Michigan, 1949); W. Samuel Yancy, M.D. (Duke, 1965).

Associate Clinical Professors: Stephen G. Kahler, M.D. (Duke, 1973); Deborah W. Kredich, M.D. (Michigan, 1962); Mary Ann Morris, M.D. (Arkansas, 1972); Lois A. Pounds, M.D. (Pittsburgh, 1965); Richard I. Schiff, M.D., Ph.D. (Duke, 1976).

Assistant Clinical Professors: Nancy E. Friedman, M.D. (Med. Coll. of Virginia, 1975); Karen H. Frush, M.D. (Duke, 1986); Marcia Herman-Giddens, P.A. (Duke, 1968), M.P.H. (North Carolina at Chapel Hill, 1985); Barbara J. Howard, M.D. (Johns Hopkins, 1975); Martha Ann Keels, D.D.S. (North Carolina at Chapel Hill, 1984), Ph.D. (North Carolina at Chapel Hill, 1990); Ave Maria Lachiewicz, M.D. (Minnesota, 1980); Sandra N. Lehrman, M.D. (Brown, 1976); Nancy Johnson-Martin, Ph.D. (North Carolina at Chapel Hill, 1961); Rupa Redding-Lallinger, M.D. (Cornell, 1980); Christine Rudd, Pharm.D. (North Carolina at Chapel Hill, 1973); Gail Spiridigliozzi, Ph.D. (Kansas, 1988).

Clinical Associates: Joanne Barton, Dr.P.H. (North Carolina at Chapel Hill), 1990; Muki W. Fairchild, M.S.W. (North Carolina at Chapel Hill, 1976); Allyn McConkie-Rosell, M.S.W. (Arkansas, 1980); F. Brandon McDaniel, M.S.W. (North Carolina at Chapel Hill, 1979); Mary V. Moggio, M.S.P.H. (North Carolina at Chapel Hill, 1972); William H. Schultz, P.A. (Duke, 1981); N. Maxine Soloway, M.S.W. (Nebraska, 1961), Ph.D. (North Carolina at Greensboro, 1985); A. William Taub, M.S.W. (North Carolina at Chapel Hill, 1981).

Associate Research Professor: David S. Millington, Ph.D. (Liverpool, England, 1969).

Assistant Research Professors: Donald Chace, Ph.D. (George Washington, 1989); Jia-Huan Ding, M.D. (Henan Med. Coll., 1970), Ph.D. (Peking Union Med. Coll., 1984); Paul C. Dolber, Ph.D. (Johns Hopkins, 1973); Michael D. Feezor, Ph.D. (North Carolina at Chapel Hill, 1969); J. Francis Heidlage, Ph.D. (Missouri, 1978); Nancy G. Henshaw, M.P.H. (North Carolina at Chapel Hill, 1981), Ph.D. (North Carolina at Chapel Hill, 1983).

Research Associates: Yong Bao, M.D. (Peking Union Med. Coll., 1986); HuiMing Liu, M.D. (Norman Bethune Univ., 1978); Vojislav D. Miletic, Ph.D. (Belgrade, 1970); Mohamed A. Nada, Ph.D. (City Univ. of New York, 1992); Rashid N. Nassar, Ph.D. (Duke, 1974); Robert D. Stevens, Ph.D. (London, 1969); Ronald F. Thomas, Ph.D. (Miami, 1973); Jer-Yuarn Wu, M.D., Ph.D. (Duke, 1985); Cui-Wei Xie, Ph.D. (Beijing Med. Univ., 1984); Bingzhi Yang, M.D. (Henan Med. Coll., 1968).

Consulting Professor: Thomas K. Oliver, Jr., M.D. (Harvard, 1949).

Associate Consulting Professors: Rosalind Coleman, M.D. (Case Western Reserve, 1969); William L. London, M.D. (North Carolina at Chapel Hill, 1955); Howard H. Loughlin, M.D. (Pennsylvania, 1970); Evelyn Schmidt, M.D. (Duke, 1951), M.P.H. (Columbia, 1962).

Assistant Consulting Professors: Clarence A. Bailey, M.D. (North Carolina at Chapel Hill, 1955); James S. Hall, Jr., M.D. (Duke, 1957); Alvin H. Hartness, M.D. (Bowman Gray, 1965); Thomas M. McCutchen, Jr., M.D. (Vanderbilt, 1963); Charles B. Neal III, M.D. (Duke, 1955); Nicholas A. Patrone, M.D. (Loyola, 1976); John C. Pollard, M.D. (Virginia, 1968); William C. Powell, M.D. (Bowman Gray, 1952); Ann Reed, M.D. (Med. Coll. of Ohio, 1984); James B. Rouse, M.D. (Duke, 1965); Frank S. Shaw, M.D. (Pennsylvania, 1959); Charles I. Sheaffer, M.D. (Western Reserve, 1958); Leonard D. Stein, M.D. (Med. Coll. of Georgia, 1975); Fred R. Stowe, M.D. (North Carolina at Chapel Hill, 1958).

Consulting Associates: Lillis Altshuler, M.D. (Cincinnati, 1960); R. Meade Christian, Jr., M.D. (Western Reserve, 1967); Douglas W. Clark, M.D. (North Carolina at Chapel Hill, 1983); William G. Conley III, M.D. (Med. Coll. of Virginia, 1960); Jean M. Findlay, M.B. (Aberdeen Univ. Med. Sch., Scotland, 1970); Gregory A. Fisher, M.D. (South Florida, 1976); Martha E. Gagliano, M.D. (Duke, 1982); Larry C. Harris, M.D. (Duke, 1977); Rufus McP. Herring, Jr., M.D. (Bowman Gray, 1969); Carl S. Hesselbart, M.S.W. (Michigan, 1980); Jennifer L. Lail, M.D. (Kentucky, 1978); Charles W. Lallier, M.D. (Virginia, 1981); Pierre C. LeMaster, M.D. (Florida, 1971); Donald N. Ludlow, Jr., M.D. (Hahnemann, 1983); Rajesh Malik, M.B. (Sheffield, England, 1981); Janice D. Stratton, M.D. (Tulane, 1961); Joseph W. Whatley, Jr., M.D. (Duke, 1958).

Emeriti: Jay M. Arena, M.D.; William Cleland, M.D.; Susan C. Dees, M.D.; Jerome S. Harris, M.D.; Bailey D. Webb, M.D., Ph.D.

Required Course

PED-205. The basic course in pediatrics for all students is an eight-week clerkship in the second year. Its principal aim is to provide an exposure to the field of child health. The student has a varying series of experiences which should give a grasp of the concepts that underlie the discipline. Goals should be to acquire familiarity and competence with the basic tools of information-gathering the history, physical examination, and laboratory data and to develop an approach to the integration of this material for the solution of problems of health and illness in infancy, childhood, and adolescence. This should be accomplished with continuing reference to the basic principles of pathophysiology encountered in the first year courses.

Those patients to whom the student is assigned will provide the focus for case studies. In addition to the careful history and physical examination which must be recorded, the student is expected to organize an appropriate differential diagnosis and to seek and read pertinent reference material relevant to each patient. The student should learn to present each case verbally in an organized and succinct fashion, to follow the patient's progress, and to interpret all studies which are performed. The student is expected to learn from a number of sources: standard textbooks and journals, current publications and conferences, and also from people—house staff, faculty, nurses, parents, and all others with whom contact is made in the clinical setting.

Objectives should also include an understanding of the roles played in pediatrics by other members of the health care team, both in the ambulatory and hospital settings. Patient care may include nurse, social worker, recreation therapist, psychologist, physiotherapist, dietitian, and/or others. The eight weeks will be divided to include time into several of the following settings: (a) Duke outpatient clinics and emergency room, (b) Duke inpatient, (c) Durham Regional Hospital, (d) Duke nursery, (e) Lincoln Community Health Center.

Electives

PED-210C. Advanced Pediatrics. This course permits the student to elect an in-depth experience within pediatrics. Each student will have a specific faculty preceptor who develops and implements the curriculum tailored to the individual's needs. Listed below are the faculty representatives to contact. Arrangements for the special topic should be made with these individuals prior to enrolling in the course.

Division: Faculty	Telephone
Allergy/Immunology: Rebecca H. Buckley, M.D.	684-2922
Cardiology: Arthur Garson, Jr., M.D., M.P.H.	681-2916
Emergency Department: Karen Frush, M.D.	684-5537
Endocrinology: Michael S. Freemark, M.D.	684-3772
General Pediatrics: Peter C. English, M.D., Ph.D.	477-4297
Poison Control: Shirley Osterhout, M.D.	684-4438
Genetics/Metabolism: Charles R. Roe, M.D.	684-2036
Hematology/Oncology: John M. Falletta, M.D.	684-3401
Infectious Diseases: Catherine M. Wilfert, M.D.	684-8772
Nephrology: Delbert Wigfall, M.D.	684-4246
Neurology: G. Robert DeLong, M.D.	684-3219
Perinatal Medicine: David T. Tanaka, M.D.	681-6024
Pulmonary: Marc Majure, M.D.	684-3364
Rheumatology: Deborah Kredich, M.D.	684-6575
Rural Health Clinics* : Joanne Barton, Dr.P.H.	684-3172
Sports Medicine: Deborah Squire, M.D.	477-4297

* The Rural Health Clinics rotation provides a broad exposure to general pediatric problems in a medically indigent community. Four days a week (Monday through Thursday) the student will travel with a senior Pediatric Resident to each of four rural county health departments to provide pediatric care in collaboration with public health nurses and child health clinicians. There is approximately two hours a day driving time, which allows for a one-on-one tutorial with the Senior Resident. A short paper on some aspect of rural child health or pediatric medicine will be required. The Special Topics course may vary from two to four weeks in length. Weight: 1 to 8. *Osterhout and departmental division chiefs*

PED-211C. Pediatric Infectious Diseases. This course will provide experience in the clinical and laboratory diagnosis of infectious diseases and in their therapy. The student works closely with the infectious disease fellow and participates actively in evaluation of patients. Daily rounds in microbiology laboratory and participation in Monday infectious disease conferences are required. Prerequisites: contact Dr. Wilfert prior to enrollment.

Weight: 4 or 8 Max: 2. *Wilfert, McKinney, Gutman, Lehrman, Katz, Drucker, Snedeker, and Walter*

PED-215C. Endocrine Disorders in Children. Students attend in the Pediatric Endocrine, Diabetes, Neuroendocrine (Brain Tumor), and Bone and Mineral Clinics and assume active roles in the evaluation and management of inpatients admitted to the Endocrine Service. Emphasis is placed upon the evaluation of growth and sexual development as indices of endocrine status during childhood. Students also participate in a monthly endocrine journal club and in weekly intra- and inter- departmental endocrine clinical and research conferences. Prerequisite: contact instructors. Weight: 4 or 8 Max: 2. *Freemark, Morris, Friedman, Thrailkill, and Fowlkes*

PED-217C. Pediatric Hematology and Oncology. Includes all aspects of clinical and laboratory pediatric hematology as well as the diagnostic evaluation, care, and treatment of patients with malignant diseases. Emphasis will be placed on fundamental concepts. There will be daily ward rounds, five clinics weekly, conferences, and seminars as well as assigned reading. Prerequisites: contact instructor. Weight: 4 or 8 Max: 2. *Falletta, Kinney, Kurtzburg, Friedman, Ware, Chaffee, Graham, Dunsmore, and Olson*

PED-221C. Poison Control. Primarily a seminar course with one, two-hour conference per week scheduled for student discussion on assigned topics. The student may participate in clinical functions of the Center and if desired may be on call for the treatment of these cases in the emergency room or the wards. This is a student-oriented teaching program and individual projects on the subject may also be carried out. Students must register for this course at least four weeks prior to the first day of class. Further, students must talk with Dr. Osterhout about the course at least one week before this same date. If permitted by the instructor, this clinical science course can be audited. Weight: 2 Max: 4. *Osterhout*

PED-225C. Neonatology. Students will have patient care responsibilities and experiences in the Duke North Intensive Care Nursery. The course involves direct participation in patient care under the supervision of the faculty and housestaff. Emphasis is placed on the initiation of parent-child relationships and a pathophysiologic approach to assessment and management of the critically ill neonate. Student may not drop within sixty days of the starting date without finding a replacement. This is a sole-enrollment course and, as such, cannot be taken in conjunction with any other course. Weight: 5 Max: 1. *Tanaka, Gingras, Goldstein, Auten, and Iafolia*

PED-227C. Behavioral Aspects of Pediatrics. This course will offer trainees the opportunity to work as a part of an interdisciplinary team in diagnosing and treating children and adolescents (ages 2-21) with a variety of psychiatric and psychosocial problems. Presenting problems might include anorexia nervosa, bulimia, enuresis, encopresis, school phobia, psychosomatic disorders, tourette syndrome, suicidal and acting-out adolescents, chronically or terminally ill children, and child abuse and neglect cases. Trainees will be taught and will clinically apply principles of child and adolescent development and psychoanalytic and family systems theory. The trainee will be involved in child, parent, and family interviews and treatment and will function as an integral part of the treatment team to experientially learn about the diagnosis and treatment of child and adolescent disorders. There will be an opportunity to be involved in the inpatient and outpatient treatment process on pediatric and adolescent psychiatric wards. C-L: PSC 227C. Weight: 2-6. *J. Jones*

PED-231C. Clinical Pediatric Cardiology. This course provides an intensive learning experience in the clinical diagnosis and management of childhood heart disease. Emphasis is placed upon the pre and post-operative management of children with operable heart disease as well as upon the management of children with non-operable heart disease. Finally, the student is exposed to pediatric acute care medicine and the modalities available to maintain cardiovascular function in the extremely ill child. Scope: history, physical examina-

tion, and special diagnostic techniques (echocardiography, electrocardiography, phonocardiography, cardiac catheterization, and cineangiography). Prerequisites: PED 205C. Weight: 4 (or 8 with special permission of the instructor) Max: 2. *Garson*

PED-233C. Allergy and Clinical Immunology. Clinical evaluation and practice in use of methods of diagnosis and treatment of allergic and immunologic disorders including the atopic diseases, immunologic deficiency states, and bone marrow transplantation. Scope: In depth seminars, history, physical examination, skin testing, a variety of clinical immunologic tests, and Clinical Research Unit experience. Weight: 4 or 8 Max: 3. *Buckley, Schiff, Markert, Williams, and Harville*

PED-234C. Clinical Genetics and Metabolism. The student will become familiar with evaluation and management of various genetic disorders including malformation syndromes and biochemical disorders. History taking, pedigree construction and analysis, specialized aspects of the dysmorphological physical examination, diagnostic techniques, routine and specialized laboratory methods (cytogenetic, biochemical, molecular), and reference materials (texts and computer programs) are covered. Students participate in weekly teaching and clinical conferences, and may take part in prenatal evaluations. May take with BCH 234B. Weight: 4 Max: 2. *Kahler*

PED-241C. Pediatric Nephrology. The course is designed to provide experience in diagnosis, interpretations of laboratory tests, natural history, and treatment of acute and chronic disorders of the kidney in children. The student is also exposed to the management of fluid and electrolyte disorders in infants and children. Prerequisites: PTH 362B suggested; prior approval of Dr. Wigfall. Weight: 4 Max: 1. *Wigfall, Scheinman, and McKay*

PED-243C. Adolescent Medicine. Students will participate in a weekly seminar with emphasis on the behavioral and developmental aspects of adolescence, drug abuse, sports medicine, and the pregnant teenager. Patient interactions will be arranged in the Youth Clinic at the Duke General Pediatric Clinic on Monday afternoon and/or the Sports Medicine Clinic on Thursday afternoon. Tutorial and supervisory time to discuss specific patients and pertinent literature will be arranged. Weight: 2 Max: 2. *Yancy, Squire, and Moses*

PED-250C. Advanced General Pediatrics, Pediatric Intensive Care Unit. This advanced course is designed to allow students a four week experience as a subintern in the Pediatric Intensive Care Unit. Under supervision of faculty attendings and resident housestaff, the senior student will assume primary responsibility for the care of critically ill children admitted to the Medicine and Surgery services in the Pediatric Intensive Care Unit. Emphasis will be placed on the development of the pathophysiologic approach to the diagnosis and therapy of a broad spectrum of pediatric illnesses as they present in acute care settings. Advanced concepts in pediatric critical care will be emphasized. Students will rotate night call with resident pediatric housestaff. Prerequisite: PED 205C. Weight: 5 Min: 1 Max: 2. *Greeley, Kern, and Malianos*

PED-260C. Advanced Clerkship in Pediatrics. This course is designed to provide the student with an intensive, in-depth exposure to the diagnosis and management of pediatric patients hospitalized at Duke. Students will be responsible for admission histories, physical examinations, and management throughout the hospitalization. The student will serve as a subintern throughout the rotation. Night call is expected every fourth night. Weight: 5 Max: 2. *Kinney, Osterhout, and faculty*

PED-281C. Pediatric Neurology. Students will examine both hospitalized and ambulatory patients with neurological disorders. Emphasis is placed on the neurological history, examination, investigation and management techniques of nervous system disorders of infancy, childhood, and adolescence. Prerequisites: contact Dr. DeLong. Weight: 4 or 8 Max: 2. *DeLong*

Pharmacology

Professor Anthony R. Means, Ph.D. (Texas at Austin, 1966), *Chairman*.

Professors: Mohamed Abou-Donia, Ph.D. (California at Berkeley, 1966); Everett H. Ellinwood, M.D. (North Carolina at Chapel Hill, 1959); Norman Kirshner, Ph.D. (Pennsylvania State, 1952); Elliott Mills, Ph.D. (Columbia, 1964); Julian Victor Nadler, Ph.D. (Yale, 1964); Saul M. Schanberg, M.D. (Yale, 1964), Ph.D. (Yale, 1961); Theodore Slotkin, Ph.D. (Rochester, 1970); Harold C. Strauss, M.D., C.M. (McGill Univ., 1964); Gary Stiles, M.D. (Vanderbilt, 1975); Pelham Wilder, Ph.D. (Harvard, 1950).

Associate Professors: Laura E. Gutman, M.D. (Stanford, 1962); Cynthia M. Kuhn, Ph.D. (Duke, 1975); James O. McNamara, Sr., M.D. (Michigan, 1968); Rochelle D. Schwartz, Ph.D. (Georgetown, 1983); Shirish Shenolikar, Ph.D. (Univ. of Leeds, 1975); A. Richard Whorton, Ph.D. (Vanderbilt, 1975).

Assistant Professors: Warner M. Burch, Jr., M.D. (Bowman Gray, 1971); Robert L. Fine, M.D. (Chicago, 1979); Robert T. Freneau, Jr., Ph.D. (George Washington, 1985); Samuel E. George, M.D. (Washington Univ. 1980); Rochelle Hanley, M.D. (Michigan, 1978); Joseph Heitman, M.D. (Cornell Univ. 1992), Ph.D. (Rockefeller Univ., 1989); Homme W. Hellinga, Ph.D. (Cambridge Univ., 1986); Tobias Myer, Ph.D. (Univ. of Basel, 1986); Ann Marie Pendergast, Ph.D. (California at Riverside, 1985); Debra A. Schwinn, M.D. (Stanford, 1983); Antonius Van Dongen, Ph.D. (Univ. of Leiden, 1988); Xiao-Fan Wang, Ph.D. (California at Los Angeles, 1986).

Research Professors: Gertrude Elion, D.Sc. (George Washington, 1969); Wilkie A. Wilson, Jr., Ph.D. (Duke, 1971).

Associate Research Professor: Jorge Bartolome, Ph.D. (Univ. of Chile, 1978).

Assistant Research Professors: Donald L. Campbell, Ph.D. (Texas at Galveston, 1986); Ram Gupta, Ph.D. (Univ. of Delhi, 1982); Qi-Yi Liu, Ph.D. (Nankai Univ., 1965); Maxine Okazaki, Ph.D. (Univ. of Toronto, 1984); Frederic J. Seidler, Ph.D. (Duke, 1986).

Adjunct Professors: Kwen-Jen Chang, Ph.D. (New York at Buffalo, 1972); Humberto Viveros, M.D. (Univ. of Chile, 1962); Joseph Yanai, Ph.D. (Univ. of Colorado, 1971).

Adjunct Associate Professors: Eli Hazum, Ph.D., (Weizman Inst. of Sci., 1978); Richard J. Kavlock, Ph.D., (Miami, 1977).

Adjunct Assistant Professors: Christopher Lau, Ph.D. (Duke, 1982); David Martin, Ph.D. (Univ. of London, 1987).

Emeritus: Leon Lack, Ph.D.

Required Course

PHR-200. Pharmacology: Mode of Action of Drugs. A basic course in pharmacology describing the action of drugs in terms of biochemical and physiological processes, and the rationale for their use in clinical therapy. Four lectures, one clinical correlation and one conference per week. 4 units. *Staff*

Electives

PHR-233B. Essential of Pharmacology. Drug absorption, distribution, excretion and metabolism; Structure and activity relationships; drug and hormone receptors and target cell responses. C-L: Graduate School. Weight: 4 Min: 5 Max: 30. *Slotkin and staff*

PHR-234B. Interdisciplinary Approach to Pharmacology. This course will highlight how research in the areas of biochemistry, cell and molecular biology, physiology, and genetics has been harnessed to the development of therapeutic strategies for the treatment of selected diseases (for example, cancer, cardiovascular disorders, Parkinsonism, and infertility). The course is aimed at demonstrating the value of an interdisciplinary approach to modern drug design and therapy. Permission of instructor required. CL: Graduate School. Weight: 3 Max: 20. *Shenolikar and staff*

PHR-254B. Mammalian Toxicology. Principles of toxicology as related to humans. Emphasis on the molecular basis for toxicity of chemical and physical agents. Subjects include metabolism and toxicokinetics, toxicologic evaluation, toxic agents, target organs, toxic effects, environmental toxicity, management of poisoning, epidemiology, risk assessment, and regulatory toxicology. Taught in alternate years in the spring semester. C-L: Graduate School. Weight: 4 Min: 10. *Abou-Donia and staff*

PHR-264B. Neurotoxicology. Adverse effects of drugs and toxicants on the central and peripheral nervous system. Target sites, pathophysiology, and factors affecting toxicity.

Experimental methods for detection and screening of neurotoxic chemicals. Screening and assessment of neurotoxicity in man. Offered spring term alternate years. Weight: 3 Min: 10. *Abou-Donia*

PHR-331B. Laboratory Methods in Pharmacology. Prerequisites: permission of instructor. C-L: Graduate School. Weight: 6. *Staff*

PHR-360B. Neuropsychopharmacology. Seminar-lecture course emphasizing neurotransmitter mechanisms and the mechanism of action of drugs used to modify nervous system function. Material will be drawn from the recent literature. Offered in alternate years. C-L: Graduate School. Weight: 3 Min: 3 Max: 30. *W. Wilson*

PHR-372B. Research in Pharmacology. Laboratory investigation in various areas of pharmacology. C-L: Graduate School. Credit to be arranged. Weight: 1-18. *Staff*

PHR-423B. Neurobiological Basis of Behavior. The course surveys neuroanatomical, neurophysiological, neurochemical, and neuropsychopharmacological evidence of central nervous system function as it relates to normal and abnormal behavior. Clinical description, measurement of function, as well as the biological substrates of affective disorders and psychoses will be emphasized. Scientific bases of current therapeutic procedures, especially psychopharmacological, will be examined. Prerequisite: familiarity with basic neuroanatomy, neurophysiology, and neuropsychopharmacology is assumed. C-L: Graduate School. Weight: 4. *Ellinwood and staff*

Psychiatry

Professor Allen Frances, M.D. (Downstate Med. Center, 1967), *Chairman*.

DIVISION OF BEHAVIORAL MEDICINE

Professor: Redford B. Williams, Jr., M.D. (Yale, 1967), *Head of Division*.

Professors: Roy J. Mathew, M.B. (Medical College of Trivandrum, India, 1970); Hsio-Shan Wang, M.D. (National Taiwan Univ., 1953).

Associate Professor: Valerie F. Holmes, M.D. (Louisville, 1980).

Assistant Clinical Professors: Indira M. Varia, M.D. (Shah Medical College, 1968); Michael R. Volow, M.D. (Seton Hall, 1964).

Clinical Associates: Katherine Enright, M.D. (Duke, 1985); Elizabeth H. King, M.D. (Duke, 1958); Katayoun Tabrizi, M.D. (Tehran Univ., 1984).

Visiting Associates: Shigetoshi Iwahashi, M.D. (Tohoku Univ., 1984); Yoshiki Tanaka, M.D. (Kyorin Univ., 1983).

Research Associate: Michael J. Helms

DIVISION OF BIOLOGICAL PSYCHIATRY

Associate Professor: K. Ranga Rama Krishnan, M.D. (Madras Med. Coll., 1978), *Acting Head of Division*.

Professors: Everett H. Ellinwood, Jr., M.D. (North Carolina at Chapel Hill, 1959); C. William Erwin, M.D. (Texas, 1960); Saul M. Schanberg, M.D., Ph.D. (Yale, 1964); Theodore A. Slotkin, Ph.D. (Rochester, 1970).

Consulting Professor: Richard J. Wyatt, M.D. (Johns Hopkins, 1964).

Adjunct Professor: Jau-Shyon Hong, Ph.D. (Kansas, 1973).

Associate Professors: Garth Bissette, Ph.D. (North Carolina State, 1982); Joseph P. McEvoy, M.D. (Vanderbilt, 1973); Richard Weiner, M.D., Ph.D. (Duke, 1973).

Assistant Professors: Lawrence A. Dunn, M.D. (Michigan, 1984); Veeraindar Goli, M.D. (Osmania Medical College, 1978); Edward D. Levin, Ph.D. (Wisconsin, 1984); William M. McDonald, M.D. (Duke, 1984); Scott D. Moore, M.D. (Virginia, 1986); Rochelle Schwartz, Ph.D. (Georgetown, 1983); Daniel C. Sullivan, M.D. (Vermont, 1970).

Assistant Clinical Professor: Stephen L. Oxley, M.D. (Kentucky, 1973).

Assistant Consulting Professor: Kumari Verghese, M.D. (Kasturba Medical College, 1972).

Associate Research Professor: Jed E. Rose, Ph.D. (California at San Diego, 1978).

Assistant Medical Research Professors: Scott T. Cain, Ph.D. (Northwestern, 1985); Tong H. Lee, M.D. (Stanford, 1988), Ph.D. (Duke, 1986); Syam Sundar, Ph.D. (India Institute of Medical Services, 1978).

Associates: Leann Nelson, M.D. (Texas, 1986); Robert G. Ruegg, Jr., M.D. (Virginia, 1970).

Clinical Associate: Frederick Cassidy, M.D. (Vanderbilt, 1988); Ursula Goebels, M.A. (Illinois, 1983); Karen Shedlack, M.D. (Massachusetts, 1985).

Consulting Associates: Byron Cole, M.D. (Cincinnati, 1960); Ugo Goetzl, M.D. (New York Med. Coll., 1968).

Adjunct Associate: Richard Weisler, M.D. (North Carolina at Chapel Hill, 1976).

Research Associates: Diane Hayden-Hixson, Ph.D. (Massachusetts, 1991); Prapti Kanani, M.D. (Bombay University, India, 1985); Arlene Nikaido, Ph.D., (Hawaii, 1982); Hong Zhang, M.D., Ph.D. (Peking Medical Univ., 1984).

Research Assistant: Ravinder Reddy Gayam, M.B.B.S. (Ghandi Medical College, India, 1981).

DIVISION OF CHILD AND ADOLESCENT PSYCHIATRY

Associate Professor: Charles R. Keith, M.D. (Harvard, 1961), *Acting Head of Division*.

Professor: John G. Looney, M.D. (Southwestern, 1969).

Visiting Research Professor: Robert Coles, M.D. (Columbia, 1954).

Associate Professor: J. David Jones, M.D. (Duke, 1954).

Associate Clinical Professor: W. Samuel Yancy, M.D. (Duke, 1961).

Associate Consulting Professor: Edgar P. Nace, M.D. (Wisconsin, 1966).

Assistant Professors: Marcelino Amaya, M.D. (Univ. Nacional Autonoma de Mexico, 1954); William B. Anderson, M.D. (Minnesota, 1948); Adrian C. Angold, B.Sc. (London Hospital Medical School, 1976); James E. Lee, M.D. (Duke, 1979); John S. March, M.D. (California at Los Angeles, 1978); Aglaia N. O'Quinn, M.D. (Duke, 1965).

Assistant Clinical Professor: Karl Stevenson, M.D. (Bowman Gray, 1966).

Assistant Consulting Professors: Ernest R. Braasch, M.D. (State Univ. New York, 1970); Cesar Guajardo, M.D. (Univ. de Nuevo Leon, Mexico, 1961); James B. Payton, M.D. (Arkansas, 1971); Ingrid Pisetsky, M.D. (Albert Einstein, 1971); Raymond F. Schmitt, Jr., M.D. (Louisiana State, 1959).

Associate: Carole R. Dunmire, M.D., Ph.D. (Rush, 1985).

Clinical Associates: Lucy T. Davis, Ed.D. (Columbia, 1955); Ranoto D. T. Hall, M.D. (East Tennessee State, 1987); Paul D. Nagy, M.S. (Florida State, 1984); Carol J. Vander-Zwaag, M.D. (Mount Sinai, 1986).

Consulting Associates: Peter F. Adland, M.D. (Georgetown, 1975); Linwood R. Allsbrook, M.D. (Kentucky, 1981); Karen K. Christian, M.D. (Minnesota, 1979); Thomas C. Cornwall, M.D. (Northwestern, 1970); Bonny Gregory, M.D. (Med. Coll. of Georgia, 1978); Bryon Herbel, M.D. (North Dakota, 1986); Carl S. Hesselbart, M.S.W. (Michigan, 1980); D. Randall Johnson, M.D. (Med. Univ. South Carolina, 1983); Nancy J. Livingston, M.D. (Duke, 1972); William Mackey, M.D. (Tennessee, 1969); Jane L. Pope, M.D. (Louisville, 1972); Margaret A. Shugart, M.D. (Med. Coll. of Virginia, 1984); Elizabeth S. Stanton, M.D. (Mississippi, 1982); Daphne Rosenblitt, M.D. (Duke, 1974); Donald L. Rosenblitt, M.D. (Duke, 1973); David A. Smith, M.D. (Alabama, 1980).

Adjunct Associate: Jean G. Spaulding, M.D. (Duke, 1972).

Instructors: Alice F. Long, M.A. (Chicago, 1953); Barbara J. Smith, M.Ed. (North Carolina Central, 1983).

DIVISION OF GENERAL PSYCHIATRY

Professor: Jesse O. Cavenar, Jr., M.D. (Arkansas, 1963), *Head of Division*.

Professor: Frederick R. Hine, M.D. (Yale, 1949).

Associate Clinical Professors: Steven Lipper, M.D. (Boston, 1972); Harold Silberman, M.D. (Washington, 1956).

Associate Consulting Professors: Francis L. A. de Marneffe, M.D. (Univ. London, 1950); David M. Hawkins, M.D. (Duke, 1966); Pedro J. Irigaray, M.D., (Univ. Nacional Autonoma de Mexico, 1955).

Assistant Professors: Elliott B. Hammett, M.D. (Duke, 1966); Kenneth W. J. Rockwell, M.D. (Duke, 1961).

Assistant Clinical Professors: Conrad C. Fulkerson, M.D. (Missouri, 1969); Harold S. Kudler, M.D. (State Univ. of New York, 1979); Patricia A. Ziel, M.D. (Michigan, 1968).

Assistant Consulting Professors: Lesley Braasch, M.D. (New York, 1970); Christine Machemer, M.D. (Freiburg, 1959); Ervin Thompson, M.D. (Vanderbilt, 1972).

Associates: Rosa F. Merino, M.D. (Case Western Reserve, 1985); Linda Roghelia Mitchell, B.S. (Campbell, 1968); Roy M. Stein, M.D. (Duke, 1980).

Clinical Associates: Michael Hertzberg, M.D. (North Carolina at Chapel Hill, 1985); Linda H. Rubin, M.P.H. (North Carolina at Chapel Hill, 1978); David C. Steffens, M.D. (Texas, 1988); Robert E. Winton, M.D. (Vanderbilt, 1972).

Consulting Associates: Jeffrey R. Chambers, M.D. (Michigan, 1986); Philip Hillsman, M.D. (Tennessee, 1987); Rose Shalom, M.D. (Harvard, 1978); Jonathan Weiner, M.D. (North Carolina at Chapel Hill, 1987).

Visiting Research Associate: Jiang Wei, M.D. (Binzhou, 1982).

DIVISION OF GERIATRIC PSYCHIATRY

Associate Professor: John C. S. Brietner, M.D., M.P.H. (Pennsylvania, 1970), *Head of Division*.

Professors: Jay P. Gibbons Professor Dan G. Blazer, M.D. (Tennessee, 1969), Ph.D. (North Carolina at Chapel Hill, 1980); Bernard J. Carroll, M.B. (Melbourne, 1964), Ph.D. (Melbourne, 1971); Daniel T. Gianturco, M.D. (Buffalo, 1960); Alan D. Whanger, M.D. (Duke, 1956).

Clinical Assistant Professor: Harold G. Koenig, M.D. (California at San Francisco, 1982).

Assistant Research Professor: Judith C. Hays, R.N., Ph.D. (Yale, 1991).

Clinical Associate: Sharon M. Wallsten, B.S.N., M.P.H. (Michigan, 1965).

Visiting Associate: Doh Kwan Kim, M.D. (Seoul National Univ., 1984).

Research Associates: James R. Bachar, Ph.D. (Pittsburgh, 1969); Bruce Burchett, Ph.D. (Carleton, 1983); Lynda C. Malmrose, Ph.D. (Pennsylvania State, 1990).

Research Assistants: Nancy Fowler, M.Ed. (North Carolina at Chapel Hill, 1971); Linda L. Jett, R.N. (Shepherd Coll., 1975); Brenda L. Plassman, Ph.D. (Arizona, 1986).

Instructor: Cornelia B. Service, M.P.H. (North Carolina at Chapel Hill, 1979).

DIVISION OF MEDICAL PSYCHOLOGY

Professor: Robert J. Thompson, Ph.D. (North Dakota, 1971), *Head of Division*.

Professors: Irving A. Alexander, Ph.D. (Princeton, 1949); Barbara J. Burns, Ph.D. (Boston Coll., 1972); Robert C. Carson, Ph.D. (Northwestern, 1957); C. Keith Conners, Ph.D. (Harvard, 1960); W. Edward Craighead, Ph.D. (Illinois, 1970); Herbert F. Crovitz, Ph.D. (Duke, 1970); Martin Lakin, Ph.D. (Chicago, 1955); Susan Schiffman, Ph.D. (Duke, 1970); S. Richard Surwit, Ph.D. (McGill, 1972).

Consulting Professor: Darwin Dorr, Ph.D. (Florida State, 1969).

Adjunct Professors: Florence Kaslow, Ph.D. (Bryn Mawr, 1969); Rune Simeonsson, Ph.D. (George Peabody College, 1971).

Associate Professors: Norman B. Anderson, Ph.D. (North Carolina at Greensboro, 1983); James A. Blumenthal, Ph.D. (Washington, 1975); Elizabeth J. Costello, Ph.D. (Univ. London, 1982); Elaine K. Crovitz, Ph.D. (Duke, 1964); John F. Curry, Ph.D. (Catholic Univ., 1978); Karen M. Gil, Ph.D. (West Virginia, 1985); Francis J. Keefe, Ph.D. (Ohio, 1975); John E. Lochman, Ph.D. (Connecticut, 1976); Patrick E. Logue, Ph.D. (North Dakota, 1965); Gail R. Marsh, Ph.D. (Iowa, 1968); Robert Shipley, Ph.D. (Michigan State, 1972); W. Derek Shows, Ph.D. (Duke, 1967); Ilene Siegler, Ph.D. (Syracuse, 1973); Karen C. Wells, Ph.D. (Georgia, 1978); William H. Wilson, Ph.D. (Vanderbilt, 1973).

Associate Clinical Professors: Jack D. Edinger, Ph.D. (Virginia Commonwealth, 1971); Rolffs S. Pinkerton, Ph.D. (Georgia, 1967); Anna L. Stout, Ph.D. (South Carolina, 1980); Scot Swartzwelder, Ph.D. (The American Univ. 1980).

Adjunct Associate Professors: Paul T. Costa, Jr. Ph.D. (Chicago, 1970); John A. Fairbank, Ph.D. (Auburn, 1980).

Associate Consulting Professor: Lenore Behar, Ph.D. (DuAssociate Research Professors: John C. Barefoot, Ph.D. (North Carolina at Chapel Hill, 1968); Gerda Fillenbaum, Ph.D. (London, 1956); David J. Madden, Ph.D. (California at Davis, 1977).

Assistant Professors: Charles F. Emery, Ph.D. (Southern California, 1985); Don D. Evans, Ph.D. (New York at Albany, 1988); Kathryn Gustafson, Ph.D. (Ohio, 1988); Karen O'Donnell, Ph.D. (North Carolina at Chapel Hill, 1983); Clive Robins, Ph.D. (State Univ. of New York, 1982); Edward C. Suarez, Ph.D. (Miami, 1986); Kathleen A. Welsh, Ph.D. (Virginia, 1985).

Assistant Clinical Professors: John Barrow, Ph.D. (Houston, 1971); Jean C. Beckham, Ph.D. (Florida State, 1988); Tracey Potts Carson, Ph.D. (Georgia, 1982); Mark Feinglos, M.D. (McGill, 1973); Steve Herman, Ph.D. (Duke, 1977); Martin Ionescu-Pioggia, Ph.D. (North Carolina at Chapel Hill, 1985); Ronette L. Kolotkin, Ph.D. (Minnesota, 1978); Albert D. Loro, Jr., Ph.D. (Washington Univ., 1976); Richard Lucas, Ph.D. (North Carolina at Chapel Hill, 1972); Laura M. Mann, Ph.D. (Missouri, 1987); Jerri M. Oehler, Ph.D. (Duke, 1984); Gail A. Spiridigliozzi, Ph.D. (Kansas, 1988); Craig R. Stenberg, Ph.D. (Denver, 1982); Joseph E. Talley, Ph.D. (Virginia, 1977).

Assistant Research Professors: George R. King, Ph.D. (New York at Stony Brook, 1989); Maya McNeilly, Ph.D. (Georgia, 1987).

Adjunct Assistant Professors: Ralph Cooper, Ph.D. (Rutgers, 1973); James A. Green, Ph.D. (North Carolina at Chapel Hill, 1979).

Adjunct Assistant Research Professor: Sandra Funk, Ph.D. (North Carolina at Chapel Hill, 1976).

Assistant Consulting Professors: William D. Barley, M.D. (Texas Tech., 1980); Rodney Lowman, Ph.D. (Michigan State, 1979).

Associate: Kathleen Wayland, Ph.D. (Duke, 1989).

Clinical Associates: Sue Ann Bauserman, Ph.D. (Georgia, 1992); Loretta E. Braxton, Ph.D. (North Carolina at Chapel Hill, 1989); Laura M. Clark, Ph.D. (North Carolina at Chapel Hill, 1992); William B. Gunn, Jr., Ph.D. (James Madison, 1986); Emily Hauck, Ph.D. (American, 1991); Barbara Keith, Ph.D. (Alabama, 1992); Lisa Lenhart, Ph.D. (North Carolina at Greensboro, 1992); Nancy J. Martin, Ph.D. (Ohio, 1992); Oliver Oyama, Ph.D. (Indiana, 1985); Kenneth Reeder, Ph.D. (Alabama, 1991); Richard R. Rumer, Ph.D. (North Carolina at Chapel Hill, 1982); Mark S. Schneider, Ph.D. (New York at Stony Brook, 1991); Robert A. Swoap, Ph.D. (Florida, 1992); Elizabeth A. Towner, Ph.D. (Rutgers, 1992); Larry A. Tupler, Ph.D. (Emory, 1989); James N. Weisberg, Ph.D. (Yeshiva, 1992); Elizabeth G. Wilson, Ph.D. (North Carolina at Chapel Hill, 1991).

Consulting Associates: Steven J. Ashby, Ph.D. (Univ. of Connecticut, 1976); Susanne E. Dunn, Ph.D. (Duke, 1989); Spencer Lylerly, Ph.D. (North Carolina State, 1987).

Instructors: John T. Edwards, Ph.D. (Univ. of Georgia, 1977); Joseph Kertesz, M.A. (Michigan, 1973); Brian Stabler, Ph.D. (North Carolina at Chapel Hill, 1973).

Research Associates: Miriam Clifford, Ph.D. (Duke, 1970); Thomas Haney, M.S.P.H. (North Carolina at Chapel Hill, 1978); Barbara Phillips, Ph.D. (Duke, 1988); Elwood L. Robinson, Ph.D. (Pennsylvania State, 1985); H. Ryan Wagner, Ph.D. (New Mexico, 1975).

DIVISION OF OUTPATIENT SERVICES

Associate Professor: Jonathan R. T. Davidson, M.D. (Univ. College, London, 1976), *Head of Division*

Professor: H. Keith H. Brodie, M.D. (Columbia, 1965).

Associate Consulting Professors: Joseph DeVeauugh-Geiss, M.D. (New York, Upstate, 1972); David M. Hawkins, M.D. (Duke, 1966).

Assistant Professor: Tana A. Grady, M.D. (Duke, 1986).

Assistant Consulting Professors: Jack W. Bonner III, M.D. (Southwestern, 1965); Ernest R. Braasch, M.D. (State Univ. of New York, 1970); Stephen Buie, M.D. (North Carolina at Chapel Hill, 1981); Martin G. Groder, M.D. (Columbia, 1964); Linda H. Jackson, M.D. (North Carolina at Chapel Hill, 1965); Eric Peterson, M.D. (Duke, 1971); Robert D. Phillips, M.D. (Pennsylvania, 1952); Leo Potts, M.D. (Univ. of Adelaide, 1954); Richard Selman, M.D. (Emory, 1972); Cynia B. Shimm, M.D. (Yale, 1950); Robert M. Wells, M.D. (Tulane, 1954).

Clinical Associates: Kenneth DiNella, M.D. (Alabama, 1987); Andrew Krystal, M.D. (Duke, 1987); Suzanne Sutherland, M.D. (Michigan State, 1988).

Associates: Lou Ann Crume, M.D. (Kentucky, 1986); Stephen Ford, M.D. (East Tennessee State, 1980); Caroline Haynes, M.D., Ph.D. (Duke, 1983); Jillian Kleiner, M.D. (Duke, 1985); Theresa A. Yuschok, M.D. (Northwestern, 1986).

Consulting Associates: John A. Ascher, M.D. (North Carolina at Chapel Hill, 1980); Lawrence Champion, M.D. (Wisconsin, 1973); Lida M. Jeck, M.D. (Duke, 1977); Rex Moody, M.D. (North Carolina at Chapel Hill, 1987); Mindy Oshrain, M.D. (Duke, 1983); Peter Z. Perault, M.D. (Vermont, 1977); Roger Perilstein, M.D. (Temple, 1982); Ernest Raba, M.D. (Texas, 1972); Kathleen Seibel, M.D. (Minnesota, 1985); Philip M. Spiro, M.D. (Yale, 1983); Nathan R. Strahl, M.D. (North Carolina at Chapel Hill, 1983); David M. Susco, M.D. (Pennsylvania State, 1983); Ronald L. Vereen, M.D. (Duke, 1981); Patricia Webster, M.S.N. (North Carolina at Chapel Hill, 1976); James R. Weiss, M.D. (Louisiana, 1973); James S. Wells, Jr., M.D. (North Carolina at Chapel Hill, 1977); Floyd C. Weisman, M.D. (Texas at Houston, 1982).

Instructors: Elizabeth Nicholes, P.A.C. (Duke, 1979); Thomas Stephenson, M.D. (Michigan, 1972).

Research Associates: Venkata R. Chittilla, M.B. (Andhra Medical College, India, 1987); Maria A. Vargas, M.D. (University of Chile, 1986).

DIVISION OF PSYCHIATRIC SOCIAL WORK

Associate: Muki Fairchild, M.S.W. (North Carolina at Chapel Hill, 1976), *Head of Division*.

Assistant Professor: Lisa Gwyther, M.S.W. (Case Western Reserve, 1969).

Clinical Assistant Professors: Carolyn H. Cole, M.S.W. (Wisconsin, 1972); Brenda Jo Kurz, Ph.D. (North Carolina at Chapel Hill, 1986); William S. Meyer, M.S.W. (Illinois, 1977); Jane Clark Moorman, M.S.W. (Tulane, 1971).

Consulting Assistant Professor: William G. Saur, M.S.W., Ph.D. (Florida State, 1980).

Associates: Maxine R. Flowers, M.S.W. (Columbia, 1964); Edward Lueth, M.S.W. (North Carolina at Chapel Hill, 1982); Diane E. Meglin, M.S.W. (Yeshiva, 1982).

Clinical Associates: Camille S. Arrington, M.S.W. (North Carolina at Chapel Hill, 1982); Edna M. Ballard, M.S.W. (North Carolina at Chapel Hill, 1980); Barbara A. Gau, M.S.W. (North Carolina at Chapel Hill); M. Jane Howard, M.S.W. (Texas, 1979); Gael McCarthy, M.S.W. (North Carolina at Chapel Hill, 1985); S. Kay Patterson, M.S.W. (Ohio State, 1967); Peter Perlman, M.S.W. (North Carolina at Chapel Hill, 1982); Debra Jean Potter, M.S.W. (North Carolina at Chapel Hill, 1987); Andrew Silberman, M.S.W. (North Carolina at Chapel Hill, 1982); Libby E. Webb, M.S.W. (Indiana, 1980).

Consulting Associates: Bess Autry, M.S.W. (North Carolina at Chapel Hill, 1976); Mary Ann Black, M.S.W. (North Carolina at Chapel Hill, 1970); Natalie R. Boorman, M.S.W. (North Carolina at Chapel Hill, 1983); Mary Jane Burns, M.S.W. (North Carolina at Chapel Hill, 1974); Lisa Gonzenbach, M.S.W. (North Carolina at Chapel Hill, 1987); Renate P. Guttman, M.S.W. (North Carolina at Chapel Hill, 1969); Stephen Hawthorne, M.S.W. (California, 1974); Debbie Hill, M.S.W. (North Carolina at Chapel Hill, 1987); Nyra Hill, M.S.W. (North Carolina at Chapel Hill, 1978); Mary Gail Holton, M.S.W. (Richmond Professional Instit., 1966); Herbert Klar, M.S.W. (Smith College of S.W., 1977); Lois P. Minis, M.S.W. (North Carolina at Chapel Hill, 1981); Betty B. Parham, M.S.W. (Smith, 1971); Anne K. Parrish, M.S.W. (North Carolina at Chapel Hill, 1963); Joye S. Pursell, M.S.W. (North Carolina at Chapel Hill, 1978); William Sims, M.S.W. (Florida State, 1975); Carolyn Thornton, M.S.W. (North Carolina at Chapel Hill, 1968); Timothy C. Wackerhagen, M.S.W. (South Carolina, 1986); Elinor T. Williams, M.S.W. (North Carolina at Chapel Hill, 1977); Margaret Wilner, M.S.W. (Columbia, 1977).

Instructors: Joy Apperson, M.S.W. (Tennessee, 1979); Christine Bell, M.S.W. (North Carolina at Chapel Hill, 1977); Nan T. Birchall, M.S.W. (Pennsylvania, 1979); Mary Sue Cherney, M.S.W. (North Carolina at Chapel Hill, 1983); James Dolan, M.S.W. (Rutgers, 1981); Nancy Durham, M.S.W. (Chicago, 1978); Marilyn Feinberg, M.S.W. (North Carolina at Chapel Hill, 1990); Eugene B. Glenn, M.S.W. (North

Carolina at Chapel Hill, 1981); Judith Herman, M.S.W. (North Carolina at Chapel Hill, 1983); Bohdan Hrynewych, M.S.W. (Catholic, 1987); Karl K. Kanoy, M.S.W. (Atlanta Univ., 1979); Barbara Keyworth, M.S.W. (North Carolina at Chapel Hill, 1981); Robert Laws, M.S.W. (North Carolina at Chapel Hill, 1978); John McLain, M.S.W. (North Carolina at Chapel Hill); Ylana N. Miller, Ph.D. (California at Berkeley, 1975); Patrick J. Murphy, M.S.W. (Our Lady of the Lake, 1974); Maureen Murray, M.S.W. (Smith, 1986); Twyla Peterson, M.S.W. (North Carolina at Chapel Hill, 1985); Marilyn D. Reedy, M.S.W. (Tulane, 1964); Susan Sweney, M.S.W. (North Carolina at Chapel Hill, 1986); Mickey Tullar, M.S.W. (North Carolina at Chapel Hill, 1982); Jean Whicker, M.S.W. (North Carolina at Chapel Hill, 1990); Bobby Williamson, M.S.W. (Michigan State, 1979); Ann S. Willoughby, M.S.W. (North Carolina at Chapel Hill, 1988); Nancy B. Winer, M.S.W. (North Carolina at Chapel Hill, 1990); Mary Ann Zabrycki, M.S.W. (Illinois, 1980).

DIVISION OF SOCIAL AND COMMUNITY PSYCHIATRY

Associate Professor: Marvin S. Swartz, M.D. (Tufts, 1980), *Head of Division*.

Professors: Kurt Back, Ph.D. (Massachusetts Inst. of Tech., 1949); James H. Carter, M.D. (Howard, 1966); Linda K. George, Ph.D. (Duke, 1975); George L. Maddox, Ph.D. (Michigan, 1956).

Associate Professors: Jacquelyne J. Jackson, Ph.D. (Ohio State, 1960); Marvin S. Swartz, M.D. (Tufts, 1980).

Associate Consulting Professor: Nicholas Stratas, M.D. (Toronto, 1957).

Assistant Professors: W. Eugene Broadhead, M.D. (Duke, 1981), Ph.D. (North Carolina at Chapel Hill, 1987); Deborah T. Gold, Ph.D. (Northwestern, 1986); Dan L. Tweed, Ph.D. (Iowa State, 1975).

Adjunct Associate Professors: David B. Larson, M.D. (Temple, 1973); Kathryn Magruder-Habib, Ph.D. (North Carolina at Chapel Hill, 1978).

Assistant Consulting Professor: Sally Johnson, M.D. (Jefferson, 1976).

Adjunct Assistant Professor: Keith G. Meador, M.D. (Louisville, 1982).

Assistant Research Professors: L. Richard Landerman, Ph.D. (Duke, 1978); Jeffrey W. Swanson, Ph.D. (Yale, 1985).

Associates: Martha E. Davidson, M.D. (Med. Coll. of Virginia, 1985); Thomas E. Sibert, M.D. (Baylor, 1983).

Clinical Associates: Joseph Balla, M.D. (Illinois, 1988); James N. Finch, M.D. (South Florida, 1981); Diane B. Gottlieb, M.D. (Med. Coll. of Pennsylvania, 1988); Lindsey Tweed, M.D. (Duke, 1987).

Consulting Associates: Bruce A. Berger, M.D. (Minnesota, 1977); Jeffrey Brantley, M.D. (North Carolina at Chapel Hill, 1977); Eugene A. Douglas, M.D. (North Carolina at Chapel Hill, 1959); Gordon Lavin, M.D. (Case Western Reserve, 1978); Thomas D. Owens, M.D. (Louisiana, 1985); Mark S. Reynolds, M.D. (Tulane, 1983); James A. Smith III, M.D. (Howard, 1976); John G. Wagnitz, M.D. (Ohio State, 1971).

Adjunct Associate: Mary Lou Melville, M.D. (Texas, 1971).

Associate in Research: Sandra C. Leak, M.A. (Duke, 1979).

Instructor: Jeffrey W. Swanson, Ph.D. (Yale, 1985).

Research Assistant: Sherrill W. Blazer, M.Ed. (Memphis State, 1969).

Lecturers: Robert Rollins, M.D. (Duke, 1956); N. P. Zarzar, M.D. (American Univ, Beirut, 1956).

Emeriti: Marie Baldwin, M.D.; Marianne Breslin, M.D.; Ewald W. Busse, M.D.; Edward Clifford, M.D.; Hallie Coppedge, M.S.W.; Bingham Dai, Ph.D.; John A. Fowler, M.D.; Robert L. Green, M.D.; Harold Harris, M.D.; Mary M. Huse, Ph.D.; Erdman Palmore, Ph.D.; Joseph B. Parker, M.D.; John M. Rhoads, M.D.; David S. Werman, M.D.; Martha L. Wertz, M.S.W.; William P. Wilson, M.D.

Required Courses

PSC-200. Consists of sixty hours devoted to human behavioral sciences basic to medicine: behavioral neurobiology, individual psychology, and the social sciences. The class is divided into small groups of ten to twelve students, each group led by two senior faculty members, with contrasting knowledge, and a psychiatric resident. Group activity consists of discussion of assigned readings in all of the areas listed above as well as interviews of psychiatric and nonpsychiatric patients intended to demonstrate behavioral science principles as well as provide opportunity for development of interviewing skills.

PSC-205. Required during the second year is an eight-week clerkship in clinical psychiatry. The student assumes limited responsibility, under supervision, for diagnosis and treatment of patients on the psychiatric wards, psychiatric outpatient clinic, and psychosomatic consultation services on nonpsychiatric wards of the hospital. Supervision is directed toward the application of concepts of diagnosis, psychopathological formulation, and therapy. These concepts are taken from descriptive, biological, psychoanalytic, and psychosocial contributions to current psychiatric thought. Supervision is also provided to develop interpersonal techniques of sensitive observation and therapeutic use of self. Emphasis is placed upon concepts and techniques applicable to all patients as well as psychiatric patients. Didactic instruction includes seminars on symptomatic, characterological, and psychophysi-

ological neurotic conditions; the major psychoses; psychiatric problems of childhood; adolescence and late life; drug and somatic therapies; the psychotherapies; and introductory electroencephalography. In addition to rounds and case conferences, students are encouraged to observe psychotherapy and to participate in supervised psychological treatment whenever appropriate situations can be provided.

Basic Science Electives

PSC-210B. Philosophy of Science and Behavioral Sciences. A reading-discussion seminar reviewing the traditional (logical empiricist) view of scientific knowledge and method followed by consideration of recent developments of thought suggesting additions and modifications to that view. Implications for the behavioral sciences in medicine are emphasized. Weight: 1 Min: 1. *Hine*

PSC-213B. Human Development: Birth - Adolescence. This course is a survey of the psychological development of the child from birth through adolescence. The first segment of the course is designed to provide the student with an awareness of some of the major theoretical orientations to child development including the psychoanalytic, Piagetian, and social learning positions. This is followed by a systematic study of the normal sequence of child development, focusing in particular on some of the major events in the cognitive, social, and emotional life of the child. The course is run in seminar fashion utilizing numerous theoretical and research papers as well as observation of children in naturalistic settings to facilitate class discussion. Students will also be required to familiarize themselves with research in child development by doing a review of the literature in a defined area. Weight: 2 Min: 1. *Curry*

PSC-215B. Comparative Personality Theory. An examination of models of human functioning. Topics will include examples from psychoanalytic, interpersonal, humanistic, behavioristic and existential approaches with the goal of recognizing personality issues that may arise within the framework of the doctor-patient relationship. A paper covering empirical approaches is required. Weight: 1. *Crovitz*

PSC-220B. Sleep Disorders. Students will initially be given a reading list and introduced to the Ambulatory Sleep Laboratory and its operations. Thereafter they will meet with the staff on four-day-a-week schedule to learn how sleep is scored in the laboratory and on a semi-weekly basis to discuss their reading. After about two weeks they will begin to formulate a research project to be carried out in the lab in conjunction with the staff. A written review of the reading and how it frames the hypotheses to be tested will be generated by the student. From this point on, further research readings will be assigned (or found by the student) to flesh out the background for the research as the project moves forward. The project will be expected to be of the quality to be formed into a manuscript and offered for publication. Data will be analyzed with the student participating fully with the staff in the statistical design and analysis. Weekly lab seminars will be used to discuss ongoing research in the lab. The student and his/her project will be a part of this ongoing seminar. Weight: 3 Max: 2. *Marsh and Erwin*

PSC-223B. Neurobiological Basis of Behavior. The course surveys neuroanatomical, neurophysiological, neurochemical and neuropharmacological evidence of central nervous system function as it relates to normal and abnormal behavior. Clinical description, measurements of function and laboratory models of function, as well as the biological substrates of affective disorders and psychoses will be emphasized. Scientific bases of current therapeutic procedures, especially psychopharmacological, will be examined. Course format consists of assigned readings, study questions, and lectures by faculty and other active researchers. Mid-term and final examinations are given. Each student is expected to critique a circumscribed area of research literature focusing on the appropriateness of conceptuali-

zations and experimental methods. Additionally, students will have an opportunity to become acquainted with, and to participate in, ongoing research. Weight: 4 Min: 1. *Ellinwood*

PSC-297B. Ethnic and Minority Health Patterns and Problems. Descriptive and analytical focus on the literature about ethnic and minority health patterns in the United States, the issues inherent therein, and the implications thereof for the delivery of medical services. Weight: 4 Min: 1. *Carter*

PSC-299B. Preceptorship in Behavioral Neurosciences. Opportunity for the student to work closely with a member of the faculty in an area of mutual interest with emphasis upon research (see the booklet, Basic Science Elective Program for Students in the Third Year Behavioral Neurosciences Study Program section for partial list of interest areas; more complete descriptions available). Weight: 1-18. *Ellinwood*

PSC-305B. Social and Cultural Aspects of Illness. Seminar on medical-social roles in community and hospital. Topics include physician-patient relationship; epidemiology of illness and health services in terms of ecology, social stratification, race, deviance, and life cycle. Proposals for improving health services are examined. Students prepare and present to the seminar a term paper on a topic of their choice. Students wishing further work in one particular topic, such as Black sub-culture or gerontology, should take PSC 299B specifying particular interest. May be taken in conjunction with PSC 251C. Weight: 3 Min: 1. *Palmore and Maddox*

Clinical Science Electives

Clinical courses offered through the Department of Psychiatry are grouped in different subject categories. These categories, and the courses within each, are shown below. General questions regarding any of the clinical rotations should be referred to Bill McDonald, M.D., Director of Medical Student Education (684-3497).

Child Psychiatry

These courses are listed as preparation for students interested in child psychiatry, pediatrics, and family practice. Interested students should contact Charles Keith, M.D., Director of Education, Division of Child Psychiatry, 286-4456 or 684-3044.

227C. Behavioral Aspects of Pediatrics

265C. Inpatient Adolescent and Family Psychiatry

266C. Clinical Management of Adolescent Inpatients

267C. Clinical Child Psychiatry Outpatient Programs

Community Psychiatry

Designed for students interested in family practice, internal medicine, and adult psychiatry. Interested students should contact Tom Sibert, M.D., Training Director, Division of Social and Community Psychiatry, 684-5274.

251C. Community Psychiatry

Family Therapy

Designed for students interested in adult psychiatry, family practice, pediatrics, and internal medicine. Interested students should contact Karen Wells, Director, Family Therapy, 684-6727.

255C. Marital and Family Factors in Medical Practice

333C. Family Psychiatry and the Therapeutic Community: Durham Regional Hospital

Forensic Psychiatry

Designed for students interested in adult and child psychiatry. Interested students should contact James Carter, M.D., 684-6102.

353C. Correctional/Forensic Psychiatry - Adult and Adolescent

Individual Psychotherapy

Designed for students interested in family practice, internal medicine, adult and child psychiatry. Interested students should contact David Werman, M.D., 684-6605.

280C. Modern Psychotherapy I: Intensive Clinical Introduction

281C. Modern Psychotherapy II: Extended Psychotherapy Experience

Management of Adult Psychiatric Inpatients

These courses are listed as preparation for students interested in adult psychiatry, family practice, internal medicine, surgery, and obstetrics and gynecology. Students interested in these courses should contact Dr. Bill McDonald, M.D., Director of Medical Student Education, 684-3497.

234C. Clinical Psychopharmacology

240C. Inpatient Psychiatry

241C. Clinical Management of Psychiatric In-Patients

263C. Treatment of Anorexia Nervosa and Bulimia

335C. Research Preceptorship in Clinical Psychiatry

336C. Biology of Depression

337C. Geriatric Psychiatry

Neuropsychiatry

Designed for students interested family practice, internal medicine, and adult psychiatry. Interested students should contact Rich Weiner, M.D., Ph.D., Director of Electroconvulsive Service.

260C. Neuropsychiatry

275C. Assessment of Sleep Disorders and Treatment

Outpatient Psychiatry

Designed for students interested in family practice, internal medicine, and adult psychiatry. Interested students should contact Steve Ford, M.D., Training Director, Psychiatric Outpatient Clinic, 684-2229.

243C. Principles and Practice of Outpatient Psychiatry

Psychosomatic Medicine

Designed as preparation for students interested in family practice, internal medicine, surgery, obstetrics and gynecology, and adult psychiatry. Students interested should contact either Indu Varia, M.D., Director, Consultation/Liaison Service, 684-4336, at Duke or Mike Volow, M.D. at the VA Hospital, 286-0411.

245C. Psychosomatic Medicine

Substance Abuse

Designed for students interested in family practice, internal medicine, and adult psychiatry. Interested students should contact Roy Mathew, M.D., Director, Duke Alcohol and Addictions Program, 684-6857 or Roy Stein, M.D., Director, Veterans Administration, 286-0411.

343C. Clinical Aspects of Alcohol and Drug Abuse.

Course Descriptions

PSC-227C. Behavioral Aspects of Pediatrics. This course will offer medical students the opportunity to study, as a part of an interdisciplinary team, the diagnosis and treatment of children and adolescents (ages 2-21) with a variety of psychiatric problems. This may include anorexia nervosa, bulimia, enuresis, encopresis, school phobia, psychosomatic disorders, tourette syndrome, suicidal and acting-out adolescents, chronically or terminally ill children and child abuse and neglect cases. Students will study principles of psychological development, psychoanalytic, and family systems theory. The student will participate in child, parent, and family interviews as an integral part of the treatment team. There will be

an opportunity to be involved in the inpatient and outpatient treatment process on pediatric and adolescent psychiatric wards. C-L: PED 227C. Weight: 2-6. J. D. Jones

PSC-234C. Clinical Psychopharmacology. Experiences at John Umstead Hospital in clinical/research in one or more areas of psychopharmacology including clinical use of drugs, human experimental psychopharmacology, evaluation of drugs based on FDA guidelines, biometric approach to ratings of psychopathology. Weight: 4 Min: 1 Max: 2. *Wilson*

PSC-240C. Inpatient Psychiatry. This course is an intensive clinical experience in the diagnosis and treatment of severe and incapacitating psychiatric disorders. The student will be given more clinical responsibility than the comparable second year inpatient rotation. Patient care responsibilities will include management of ward milieu. Treatment approaches emphasizing psychotropic medication, individual, family, and group psychotherapy will be part of the clinical experience. Participation at selected patient care conferences and didactic lectures is expected. The rotation is available at Duke and the VA. The rotation at the VA will include admission decision-making. At Duke, specialty program experience is available. This experience can be structured to include a survey of the variety of residential treatment available in this area. If desired, a student can arrange for a special reading tutorial in related topics (e.g., schizophrenia). Weight: 4 or 8 Max: 4. *Cavenar and Oxley*

PSC-241C. Clinical Management of Psychiatric In-Patients. Purpose of this course is to develop skills and knowledge in providing clinical care and intensive diagnostic assessments to hospitalized psychiatric patients. Students will be allowed to rotate through different diagnostic modules to have varied experience in psychiatric disorders. There will be close faculty supervision while they are performing subinternship role. They will learn basic concepts and treatments, through ongoing didactic lecture series of major psychiatric illness. There is heavy emphasis in psychopharmacology, psychosocial interventions, and individual therapy during this rotation. There will be individual case assignments with whom the student will work closely in providing inpatient care. This rotation is available at John Umstead Hospital, acute Adult Admission Unit. Students will be reimbursed for their travel. Weight: 4 or 8 Max: 4. *Merino, K. Rayasam, and McEvoy*

PSC-243C. Principles and Practice of Outpatient Psychiatry. Training and experience in recognizing and treating emotional disorders in outpatients. Supervised experience (primarily observational) with patients having emotional problems commonly seen in medical practice. This training will include theory and techniques of brief psychotherapy, medication management, supportive psychotherapy, and utilization of community resources both at Duke Hospital and neighboring agencies. Although it may be possible to do some clinical work in working with patients (i.e., interviewing, evaluations and possibly observing other people do therapy), the primary education will be in attending A.R.T.s, mini team, medication clinic, and various other seminars. Because of the nature of out-patient work it is suggested that the student take the longer (eight week section) rather than one of the shorter rotations. Please contact Dr. Ford at least eight weeks in advance to arrange this rotation. Weight: 3-8 Max: 4. *Ford*

PSC-245C. Psychosomatic Medicine. The consultation-liaison services at both Duke Medical Center and VA Hospital offer clinical clerkships in the management psychological problems of medical patients and somatic symptoms in psychiatric patients. The student does psychiatric consultations in various specialized medical and surgical services under supervision of residents and senior staff. Emphasis is placed on training the student in advanced interviewing techniques and in assessment and intervention for psychological reactions or depression due to medical illness. In the past, students have chosen among cardiac disease, oncology and death and dying, pain, hemodialysis, intensive care, and gynecologic problems. The site selected and the specific specialty area chosen depends on the availability and location of psychiatric consultants with those interests. The rotation is flexible. We will try to match student interests with the interests of available consultants.

Students need to check with Dr. Volow (VA) or Dr. Varia (Duke) on the current availability of specialty areas. Weight: 4 or 8 Max: 4. *Volow and Varia*

PSC-251C. Community Psychiatry. The student will develop a course based on selections from a variety of community and special population settings. This includes the Durham Mental Health Center and its component units (children's services, alcohol and drug abuse and dependency treatment programs, programs for the care and training of the mentally retarded and adult psychiatry services), the Federal Corrections Center at Butner, and the psychiatric service at the Lincoln Community Health Center. Students interested in this elective must contact Dr. Tom Sibert at least four weeks prior to the term selected for this course in order to develop a program tailored to the student's interests. Weight: 4 or 8 Max: 8. *Swartz, Sibert, and Carter*

PSC-255C. Marital and Family Factors in Medical Practice. The student will develop knowledge in the basic theoretical and clinical concepts of the marital and family relationship and learn to recognize, evaluate, and treat patients who present with marital and family problems. The orientation will be for the physician delivering primary care. Emphasis will be placed on the relationship between marital dynamics and compliance with the treatment regimens and the course of different illnesses. Didactic and case material will be presented in seminar format. Students will be expected to present case material for discussion. If permitted by the instructor, this clinical science course can be audited. Weight: 1 Max: 4. *Wells*

PSC-260C. Neuropsychiatry. Neuropsychiatry is the study of how alterations in brain structure and function produce disturbances in human behavior. In this course, the student will become familiar with the major neuropsychiatric syndromes: dementia, delirium, and selective organic mental syndromes such as organic personality syndrome (e.g., frontal lobe syndrome) and organic affective syndrome (e.g., post-stroke depression). The student will develop an understanding of diagnosis and treatment based upon a multidisciplinary clinical approach including specialized clinical neuropsychiatric exams. The patient population will be drawn from the Duke Medical Center and Durham VA Hospital psychiatry, neurology, and neurosurgery services. Depending on the site, the student may also have an opportunity to become familiar with specialized neuropsychiatric approaches including psychometric testing and neural imaging techniques such as EEG and computerized EEG, CT scan, MRI, cerebral blood flow, and PET scan. Depending on site, some customization of the elective can be arranged in advance. Weight: 2-4 Max: 2. *Volow*

PSC-263C. Treatment of Anorexia Nervosa and Bulimia. The purpose of this course is to train students in recognizing and treating anorexia nervosa and bulimia. The experience is offered in a multi-model treatment setting and includes: participation in inpatient team meetings, individual psychotherapy sessions with inpatients, observation of family sessions, and participation in out-patient support groups. Weight: 4 or 8 Max: 2. *Rockwell and Ellinwood*

PSC-264C. Theory and Practice of Psychiatry in a Private Hospital. Evaluation, diagnosis, and treatment of a wide variety of psychiatric problems with special emphasis on those problems which best respond to long-term treatment approaches. The development and execution of an individualized treatment plan for each patient as well as learning to coordinate treatment team members services is also stressed. Emphasis will be on the active involvement of the student in psychiatric hospital (Highland Hospital).

The student will work closely with senior staff psychiatrists toward that goal, as well as be involved in hospital-wide conferences. Weight: 4-9. *Selman*

PSC-265C. Inpatient Adolescent and Family Psychiatry. Adolescent and family psychopathology are emphasized in the full time clinical rotation at the Children's Psychiatric Institute, John Umstead Hospital, Butner. The experience offered is an intensive and

rich one with opportunities to observe and treat patients and their families. Group and individual supervision, collaboration with milieu team members, and diagnostic and treatment conferences are heavily emphasized. Weight: 8 Max: 4. *Guajardo*

PSC-266C. Clinical Management of Adolescent Inpatients. This course consists of well supervised clinical care for adolescents with various psychopathologic disorders. Each student will be an integral member of the clinical team with opportunities for participating in individual and group psychotherapy as well as family therapy and parent counseling. A senior staff psychiatrist will be assigned as a preceptor. Students may also choose to rotate through the Teer House Day Hospital. Students work with early adolescents and their families in a continuum of care setting. There will be opportunities to participate in family therapy sessions, recreational and educational activities, team meetings concerning patient management and substance abuse programs. The student will learn about adolescent development, family and parent interactional problems as they impact on adolescent development and the common forms of adolescent psychopathology and their treatment in a day hospital setting. Senior staff psychiatrist on the Teer House staff will serve as preceptors. Weight: 4 or 8 Max: 3. *W. Anderson and Curry (for students working with adolescent inpatients) and J.D. Jones (for students working primarily in the Day Hospital Adolescent Psychiatry program)*

PSC-267C. Clinical Child Psychiatry Outpatient Programs. Under supervision, the student will perform diagnostic evaluations and short-term treatment with parents, children, and families and may participate in one or more of the following specialty programs: a) therapeutic kindergarten and elementary school; b) juvenile court clinic; c) conduct disorder clinic. Child development and the psychobiological and psychodynamic perspectives of childhood psychopathology will be emphasized. Weight: 3 or 6 Max: 2. *Keith and Lochman*

PSC-275C. Assessment of Sleep Disorders and Treatment. The student will participate in our weekly Sleep Clinic which assesses three to four patients with sleep problems every Tuesday morning. This is followed by a conference which allows the staff and the students to discuss the cases seen in follow up. This conference is also used to discuss general problems in sleep disorders, quality control of our sleep evaluations, and recent research findings of relevance to the laboratory. The students will also come to the laboratory one morning per week to participate in the scoring of overnight polysomnographic recordings of patients receiving evaluation. They will be expected to learn the scoring system and perform some evaluations with staff supervision. There are numerous records in our laboratory upon which they may also practice to sharpen their skill. They will be free to participate in the several research questions being pursued in the laboratory by the staff. An introduction to the lab will provide the student with an overview of equipment, lab operations, and the ongoing research questions. A reading list will also be provided to allow the student to acquire background on the cases seen in the laboratory. Weight: 3 Max: 2. *Erwin and Marsh*

PSC-280C. Modern Psychotherapy I: Intensive Clinical Introduction. In this full-time (or near full-time) introduction, the student participates actively in assessment of outpatients for psychotherapy, short-term psychotherapy of inpatients, ongoing psychotherapy groups, and family therapy sessions. In addition he/she attends seminars on the various psychotherapeutic approaches: psychoanalytically oriented, cognitive, behavioral, interpersonal, systemic, etc. Readings will be assigned and discussed. The student may pursue an area of special interest in greater depth with a selected preceptor. Weight: 4 Min: 1. *H. Kudler, E. Thompson, Gianturco, and Werman*

PSC-281C. Modern Psychotherapy II: Extended Psychotherapy Experience. The student will: 1) undertake the individual psychotherapy of a patient with weekly supervisory review by a faculty member of the therapy sessions or, 2) participate as co-therapist with a member of the faculty in the sessions of a therapeutic group or a family therapy with follow-up discussion of each session. This course may be elected for the twelve weeks of the

fall term following Modern Psychotherapy, for twenty weeks (to the middle of the spring term) or, optimally, for the entire remainder of the fourth year. Two to four hours per week will be required. Some additional reading will be included. Prerequisite: Modern Psychotherapy I. Weight: 1 credit per 12 weeks Min: 1. *H. Kudler, E. Thompson, Gianturco, and Werman*

PSC-333C. Family Psychiatry and the Therapeutic Community: Durham Regional Hospital. Students will evaluate and treat patients within a family-oriented therapeutic community. The principles and practice of psychiatric diagnosis and treatment in a community setting will be stressed. Advanced students will participate in family therapy, group therapy, and the total management of the patient. Weight: 4-8. *Winton*

PSC-335C. Research Preceptorship in Clinical Psychiatry. This course allows the student to work on a research project in clinical psychiatry with selected members of the psychiatric staff. Weight: 3-8 Max: 4. *Ellinwood and clinical staff by arrangement*

PSC-336C. Biology of Depression. This elective will focus on the diagnostic, nosologic, treatment, and research aspects of depression in adult and late life. The student will be delegated clinical responsibility and he/she will be closely involved with the treatment team of the Affective Disorders Specialty Clinic. Participation at team meetings and diagnostic conferences is expected. Weight: 4 or 8 Max: 1. *McDonald*

PSC-337C. Geriatric Psychiatry. The medical and clinical aspects of geriatric psychiatry with emphasis on diagnosis and management of geriatric patients in a variety of treatment facilities. Course includes attendance at scheduled conferences and supervised review of geriatric literature. Weight: 3-8 Max: 8. *A. Allen*

PSC-343C. Clinical Aspects of Alcohol and Drug Abuse. This course offers a part-time or full-time experience at the Duke Alcoholism and Addiction Program or the VA Hospital in the diagnosis and treatment for patients who abuse alcohol and/or drugs. The interrelations of substance abuse with personality disorder and major psychiatric disorder is emphasized. Students may also choose to rotate on an inpatient/outpatient substance abuse program at Duke Alcohol Program or the VA Hospital. Weight: 4-8 Min: 1 Max: 8. *Mathew and Stein*

PSC-353C. Correctional/Forensic Psychiatry—Adult and Adolescent. Part-time or full-time experience in a correctional setting is offered. Diagnosis and treatment of adult and adolescent offenders with a variety of medical illnesses and behavioral disturbances are recognized. Elements of forensic psychiatry are stressed where appropriate. Supervision is provided by Duke faculty and the Central Prison Hospital and Mental Health staff. Opportunities for participation in a wide range of original and continuing research are available. Weight: 2-9 Max: 3. *Carter*

Radiation Oncology

Professor: Leonard Prosnitz, M.D. (State Univ. of New York, 1961), *Chairman*.

Professors: Randy Jirtle, Ph.D. (Wisconsin, 1975); Gustavo S. Montana, M.D. (Bogota, Columbia, 1960); James Oleson, M.D., Ph.D. (Arizona, 1976).

Associate Professors: Mark Dewhirst, Ph.D., D.V.M. (Colorado, 1979); Edward Halperin, M.D. (Yale, 1979); Thaddeus Samulski, Ph.D. (New York at Buffalo, 1975); Marc Sontag, Ph.D. (Univ. of Toronto, 1979).

Assistant Professors: Mitchell Anscher, M.D. (Virginia, 1981); David Brizel, M.D. (Northwestern, 1983); Scott Clegg, Ph.D. (Arizona, 1988); Kenneth Leopold, M.D. (Pennsylvania, 1982); Lawrence B. Marks, M.D. (Rochester, 1985); David Spencer, Ph.D. (Univ. British Columbia, 1985); Kenneth B. Weeks, Ph.D. (Texas at Austin, 1978).

Instructor: Angel Torano, M.D. (Johns Hopkins, 1987).

Associates: Gunilla C. Bentel (Orebro Lans Sjukskoterskeskola, 1961); Conrad Knight; Sujit Ray, Ph.D. (Duke, 1987).

Research Associates: James Blackburn, Deborah McLeod Prescott (North Carolina State, 1989).

Emeriti: Fearghus O'Foghludha, Ph.D.

Electives

RON-227B. General Radiobiology. This course provides a comprehensive overview of radiation's interactions with cells and/or tissues and is oriented toward gaining an understanding of such interactions as they relate to the therapeutic use of radiation alone or in combination with chemotherapeutic drugs. Topics that are covered include carcinogenesis; radiation protection mutagenesis; DNA damage and repair; oncogene, suppressor gene and growth factor expression; methods for quantitating radiation damage in vitro and in vivo; tumor and normal tissue models for radiation studies; solid tumor metabolism, microenvironment, and physiology; radiation sensitizers and protectors; effects at the tissue and whole organ and whole organism level; time, dose, and fractionation; low dose rate radiotherapy, including use of radiolabelled monoclonal antibodies; hyperthermia; radiation/drug and heat/drug interactions. Weight: 2 Max: 10. *DeWhirst*

RON-228B. The Basic Science of Oncology. In this course we will discuss the molecular and cellular biology of cancer including oncogenes, tumor suppressor genes, growth factors, chromosomal abnormalities, cellular invasion and metastases, and the control of cell cycling. Tumor biology will be considered including concepts of tumor doubling time, cell loss, tumor hypoxia, and fiber and foreign body, viral, and tobacco induced carcinogenesis/mutagenesis. The course will conclude with a consideration of the basic science underlying cancer prevention, diagnosis, and therapy including the pharmacology of cancer chemotherapy, biologic and immunotherapy principles, radiobiology and hyperthermic oncology, and the scientific basis of surgical oncology practice. Weight: 3 Min: 3 Max: 25. *Halperin, Horowitz, and guest lecturers*

RON-215C. Clinical Radiation Oncology. Radiation Oncology plays a crucial role in the management of patients with cancer. The student will begin this course with lectures, individual tutorials, and audio-visual education programs to review the crucial elements of radiation biology, medical radiation physics, and dosimetry. This will be followed by clinical instruction based in the ambulatory clinics of the Radiation Oncology Department as well as participation in brachytherapy procedures, care of inpatients, and new patient consultations. This course will provide an introduction to the role of radiation therapy in the treatment of malignant disease. Weight: 4 or 8 Max: 2. *Halperin and staff*

Radiology

Professor: Carl E. Ravin, M.D. (Cornell, 1968), *Chairman*.

Professors: James D. Bowie, M.D. (Oklahoma, 1967); Barbara Carroll, M.D. (Stanford, 1972); James T. T. Chen, M.D. (Natl. Defense Med. Ctr., Taiwan, 1950); R. Edward Coleman, M.D. (Washington Univ., 1968); Herman Grossman, M.D. (Columbia, 1953); E. Ralph Heinz, M.D. (Pennsylvania, 1955); Ronald Jaszczak, Ph.D. (Florida, 1968); G. Allan Johnson, Ph.D. (Duke, 1974); Salutarior Martinez, M.D. (Havana Univ., 1961); James B. Duke Professor Charles E. Putman, M.D. (Texas at Galveston, 1967); Reed P. Rice, M.D. (Indiana, 1955); H. Dirk Sostman, M.D. (Yale, 1976); Leonard D. Spicer, Ph.D. (Yale, 1968); Michael R. Zalutsky, Ph.D. (Washington Univ., 1974).

Clinical Professor: Philip C. Goodman, M.D. (California at Los Angeles, 1970).

Associate Professors: Mark E. Baker, M.D. (Loyola, 1978); William H. Briner, B.S. (Temple, 1954); William Currie, Ph.D. (North Carolina at Chapel Hill, 1964); Carey Floyd, Jr., Ph.D. (Duke, 1981); William Foster, Jr. M.D. (Duke, 1973); Barbara Hertzberg, M.D. (Duke, 1980); Glenn E. Newman, M.D. (Duke, 1973); Charles Spritzer, M.D. (Pittsburgh, 1981); Daniel C. Sullivan, M.D. (Vermont, 1970); Robert D. Tien, M.D. (National Taiwan Univ., 1981); Robert H. Wilkinson, Jr., M.D. (Washington Univ. 1958).

Associate Clinical Professor: Roger H. Shannon, M.D. (George Washington, 1956).

Associate Research Professor: Laurence Hedlund, Ph.D. (Pittsburgh, 1968).

Assistant Professors: Orest B. Boyko, M.D., Ph.D. (Indiana, 1982); Michael F. Brothers, M.D. (Dalhousie, 1980); Hal Cecil Charles, Ph.D. (New Orleans, 1981); Andrew J. Collins, M.D. (New Jersey, 1983); James Dobbins III, Ph.D. (Wisconsin, 1985); Donald P. Frush, M.D. (Duke, 1985); Edgardo Ismael Gimenez, M.D. (Univ. La Plata, Argentina, 1975); David Gulliver, M.D. (Royal North Shore Hospital, 1989); Michael W. Hanson, M.D. (West Virginia, 1974); John M. Hoffman, M.D. (Colorado, 1980); Mark A. Kiewer, M.D. (Duke, 1985); Mark H. Knelson, M.D. (North Carolina at Chapel Hill, 1985); Phyllis J. Kornguth, M.D., Ph.D. (Boston, 1976); Richard A. Leder, M.D. (Boston, 1984); Linda Gray Leithe, M.D. (Ohio State, 1982); Laurie Lomasney, M.D. (Cincinnati, 1986); James R. MacFall, Ph.D. (Maryland, 1976); Cindy R. Miller, M.D. (George Washington, 1985); Alan Ost,

M.D. (Med. Coll. of Virginia, 1987); Edward F. Patz, Jr., M.D. (Maryland, 1985); Erik K. Paulson, M.D. (Duke, 1985); James M. Provenzale, M.D. (Albany, 1983); Paul Suhocki, M.D. (Georgetown, 1985); Robert Vandemark, M.D. (Upstate Med. Center, 1980); Therese M. Weber, M.D. (Oklahoma, 1985).

Assistant Clinical Professors: Donald E. Sallee, M.D. (Missouri, 1985); Margaret Eileen Williford, M.D. (Duke, 1976).

Assistant Research Professors: Pradeep Garg, Ph.D. (Lucknow Univ., 1982); Helene Benveniste, M.D., Ph.D. (Univ. of Copenhagen, 1991).

Associates: Robert L. Ballard, M.D. (Oklahoma, 1983); Salvador Borges-Neto, M.D. (Federal Fluminense Univ., 1980); Paul W. Burrowes, M.D. (British Columbia, 1975); Carlos Cardenas, M.D. (South Florida, 1987); Anne DeAtkine, M.D. (Texas-Southwestern, 1987); David Enterline, M.D. (North Carolina at Chapel Hill, 1982); Gary Felsberg, M.D. (Boston Univ., 1987); Nick Ferris, M.D. (Monash Univ., 1983); David Furie, M.D. (Mount Sinai, 1987); Edwin R. Hudson, M.D. (East Tennessee, 1987); Mary T. Keogan, M.D. (Trinity, 1985); Julie Kreager, M.D. (Duke, 1987); Robert Lile, M.D. (Vanderbilt, 1987); Val Lowe, M.D. (McGill, 1988); Jeff McClellan, M.D. (Utah, 1987); Michael Meyers, M.D. (Manitoba, 1984); Alan Osumi, M.D. (California at San Diego, 1986); Cynthia Payne, M.D. (Med. Coll. of Ohio, 1980); Robert E. Reiman, M.D. (Case Western, 1987); James Schumacher, M.D. (Duke, 1987); Mary Scott Soo, M.D. (Bowman Gray, 1987); Kevin Tribble, M.D. (Loyola Stritch, 1987); Richard Tupler, M.D. (Florida, 1988); Jennifer Van Vickie, M.D. (Duke, 1986).

Required Course

RAD-200. The basic course in radiology for all medical students is combined with physical diagnosis and laboratory diagnosis into IND-200. The course is a concentrated lecture series with correlating demonstration laboratories designed to provide a broad introductory exposure to the entire field of diagnostic radiology.

Electives

RAD-250B. Research In Radiology. An individually arranged experience in which the student identifies with and participates in an established research program of a faculty member. Program should be arranged with DPA and proposed faculty member well in advance of starting date. Weight: 1-18 Max: 10. *G.A. Johnson*

RAD-210C. Pediatric Radiology. A specialized program of instruction and participation in the wide variety of radiographic examinations in the pediatric age group. Special correlation of these examinations to the problems of specific diagnosis and patient care will be made. Prerequisite: must contact Dr. Grossman prior to registration. Weight: 4 or 8 Max: 2. *Grossman and staff*

RAD-211C. Clerkship In Neuroradiology. A specialized program of detailed instruction in neuroradiology. The program includes participation in many interdepartmental conferences and the performance and interpretation of a variety of examinations: including cerebral angiography, computerized axial tomography, magnetic resonance images and myelography. Prerequisites: must contact Dr. Tien prior to registration. Weight: 4 or 8 Max: 2. *Tien and staff*

RAD-229C. Basic Radiology Clerkship. This course is designed to provide an overview of the various imaging modalities of diagnostic radiology and their clinical utility. The elective consists of: (a) a series of lectures and film interpretation sessions supplemented by student presentations; (b) assignment to a variety of diagnostic radiology services during which students observe the performance of diagnostic and interventional studies and discuss film interpretation; (c) use of an extensive teaching file of radiographs and audiovisual tapes. One week is spent on the thoracic radiology service. Additions rotations include the musculoskeletal, neuroradiology, mammography, vascular/interventional, pediatric, CT, ultrasound, MRI, nuclear medicine and VA Hospital services. Weight: 4 Min: 4 Max: 8. *Goodman and staff*

Surgery

James B. Duke Professor David C. Sabiston, Jr., M.D. (Johns Hopkins, 1947), *Chairman.*

DIVISIONS OF GENERAL AND CARDIOTHORACIC SURGERY

Professors: William G. Anlyan, M.D. (Yale, 1949); Ralph R. Bollinger, M.D. (Tulane, 1970), Ph.D. (Duke, 1977); James B. Duke Professor Dani P. Bolognesi, Ph.D. (Duke, 1964), Experimental Surgery; Eli Gilboa, Ph.D. (Weizmann Institute of Science, Israel, 1977), Experimental Surgery; Mary and Deryl Hart Professor of Surgery Robert H. Jones, M.D. (Johns Hopkins, 1965); James E. Lowe, M.D. (California at Los Angeles, 1973); Richard L. McCann, M.D. (Cornell, 1974); William C. Meyers, M.D. (Columbia, 1975); Joseph A. Moylan, Jr., M.D. (Boston, 1964); H. Newland Oldham, Jr., M.D. (Baylor, 1961); Keith T. Oldham, M.D. (Med. Coll. of Virginia, 1976); Jeffrey L. Platt, M.D. (California at Los Angeles, 1977); Hilliard F. Seigler, M.D. (North Carolina at Chapel Hill, 1960); Delford L. Stickel, M.D. (Duke, 1953); John L. Weinerth, M.D. (Harvard, 1967); Walter G. Wolfe, M.D. (Temple, 1963); W. Glenn Young, Jr., M.D. (Duke, 1948).

Research Professors: Per-Otto F. Hagen, F.H.W.C. (Watt University, Edinburgh, Scotland, 1961), Experimental Surgery; Alphonse J. Langlois, Ph.D. (Duke, 1966), Experimental Surgery.

Consulting Professor: Steward M. Scott, M.D. (Baylor, 1951).

Clinical Professor: Hartwiz Bunzendahl, M.D. (University of Heidelberg, 1974).

Associate Professors: Onyekwere Akwari, M.D. (Southern California, 1970); Darell D. Bigner, M.D. (Duke, 1965), Ph.D. (Duke, 1971), Experimental Surgery; Gregory S. Georgiade, M.D. (Duke, 1973); John P. Grant, M.D. (Chicago, 1969); Karen S. Guice, M.D. (Univ. of New Mexico, 1977); J. Dirk Iglehart, M.D. (Harvard, 1975); George S. Leight, Jr., M.D. (Duke, 1972); Thomas J. Matthews, Ph.D. (Missouri, 1971), Experimental Surgery; Theodore N. Pappas, M.D. (Ohio State, 1981); Emil R. Petrusa, Jr., Ph.D. (University of Utah, 1979); R. Lawrence Reed II, M.D. (Virginia, 1976); Robert N. Sladen, M.B., Ch.B. (Univ. of Cape Town Med. Coll., South Africa, 1970); Peter K. Smith, M.D. (Duke, 1977); Ross M. Ungerleider, M.D. (Rush, 1976); Peter Van Trigt III, M.D. (Tulane, 1977); Kent J. Weinhold, Ph.D. (Pennsylvania, 1979), Experimental Surgery.

Associate Research Professor: David C. Monefiori, Ph.D. (Clemson, 1982).

Adjunct Associate Professor: Jeffrey J. Collins, Ph.D. (Harvard, 1972), Experimental Surgery.

Assistant Professors: Steven J. Bredhoeft, M.D. (Kansas, 1974); Norbertus P. DeBuijn, M.D., M.Sc. (Univ. of Gronigen, 1976); Kathleen A. Devine, M.D. (Maryland, 1987), Emergency Medicine; James M. Douglas, Jr., M.D. (Duke, 1978); Donald D. Glower, Jr., M.D. (Johns Hopkins, 1980); Robert C. Harland, M.D. (Duke, 1983); H. Kim Lyerly, M.D. (California at Los Angeles, 1983); Samuel M. Mahaffey, M.D. (West Virginia, 1979); Barbara A. Murphy, M.D. (Med. Coll. of Pennsylvania, 1975), Emergency Medicine; Glenn E. Newman, M.D. (Duke, 1973); Ares D. Pasipoularides, M.D. (Minnesota, 1971), Ph.D. (Minnesota, 1972); Lloyd R. Smith, Ph.D. (Alabama, 1985); Frances E. Ward, Ph.D. (Brown, 1965), Experimental Surgery; David K. Wellman, M.D. (Duke, 1971), Emergency Medicine.

Assistant Research Professors: Zeinab A. Abdel-Wahab, Ph.D. (Eastern Virginia, 1985), Experimental Surgery; Timothy L. Darrow, Ph.D. (State Univ. of New York, 1980); Michael L. Greenberg, Ph.D. (State Univ. of New York, 1984), Experimental Surgery; Jeffrey R. Marks, Ph.D. (California, 1985), Experimental Surgery; Lawrence H. Muhlbaier, Ph.D. (North Carolina at Chapel Hill, 1981), Experimental Surgery.

Assistant Clinical Professor: C. Michael Schuch, B.A. (North Carolina at Chapel Hill, 1977).

Assistant Consulting Professors: George M. Bilbrey, Jr., M.D. (Alabama, 1962); Albert H. Bridgman, M.D. (Louisiana, 1956); Rollins S. Burhans, Jr., M.D. (Louisville, 1963); Gordon M. Carver, M.D. (Duke, 1948); Calvin P. Claxton, M.D. (Virginia, 1961); Eduardo Cuison, M.D. (College of Medicine and Surgery, Santo Tomas, 1967); John T. Daniel, M.D. (Howard, 1964); David N. DuBois, M.D. (Georgetown, 1983); Peter A. Gentling, M.D. (Northwestern, 1964); Norman A. Hetzler, Jr., M.D. (Hahnemann, 1982); Charles A. Keller, Jr., M.D. (Louisiana State, 1959); Robert W. Kieffer, M.D. (Johns Hopkins, 1978); Walter J. Loeher, M.D. (Cornell, 1963); F. Maxton Mauney, Jr., M.D. (Duke, 1959); Keith M. Maxwell, M.D. (Oral Roberts, 1982); W. B. McCutcheon, Jr., M.D. (Virginia, 1952); Amir A. Neshat, M.D. (Isfahan University, Iran, 1960); Stephen K. Rerych, M.D. (Columbia, 1974); Henry E. Russell, M.D. (Northwestern, 1972); Guido F. Saldana, M.D. (Santo Domingo University, 1961); James P. Weaver, M.D. (Pennsylvania, 1969); James S. Wilson, Jr., M.D. (North Carolina at Chapel Hill, 1975).

Adjunct Assistant Professor: Stephen R. Petteway, Jr., Ph.D., (Alabama, 1980), Experimental Surgery. Medical Center Instructor: Soheyla S. Saadi, Ph.D. (New York Univ., 1985).

Clinical Associate: Paul Hendrix, B.S. (Coll. of Charleston, 1970), B.H.S. (Duke, 1975).

Research Associates: Chin Ho Chen, Ph.D. (North Carolina at Chapel Hill, 1985); James W. Davis, M.S.E.E. (Duke, 1974); Gudrun Huper, M.A. (Stuttgart, Germany); Emmanuel C. Opara, Ph.D. (Univ. of London, 1984); P. V. Ravindra, M.B.B.S. (Kempegowda Institute of Med. Sciences, India, 1988); Laurence T. Rimsky-Clarke, Ph.D. (University of Paris, 1984); Carl T. Wild, Ph.D. (Virginia Polytechnic and State Univ., 1988).

DIVISION OF NEUROSURGERY

Professor: Robert H. Wilkins, M.D. (Pittsburgh, 1959), *Chief*.

Professor: Blaine S. Nashold, M.D. (Louisville, 1949).

Associate Professors: Wesley A. Cook, Jr., M.D. (Oregon, 1963); Allan H. Friedman, M.D. (Illinois, 1974).

Associate Research Professor: Roger Madison, Ph.D. (Duke, 1981), Experimental Surgery.

Assistant Professors: Michael F. Brothers, M.D. (Dalhousie University, Nova Scotia, 1980); Herbert E. Fuchs, M.D., Ph.D. (Duke, 1984); Richard S. Kramer, M.D. (Duke, 1962); Ziaur Rahman, M.B. (Prince of Wales Med. Coll., India, 1968); Dennis A. Turner, M.D. (Indiana, 1975); Bruno J. Urban, M.D. (Germany, 1960).

Assistant Consulting Professors: Peter R. Bronec, M.D. (Duke, 1981); Bruce L. Kihlstrom, M.D. (North Carolina at Chapel Hill, 1972); Robert E. Price, Jr., M.D. (North Carolina at Chapel Hill, 1964).

Research Associates: Simon J. Archibald, Ph.D. (North Staffordshire Polytechnic, Bioengineering Unit, 1984); Janice O. Levitt, Ph.D. (Temple, 1963); Robert D. Pearlstein, M.S. (North Carolina at Chapel Hill, 1978); Gowri K. Pyapali, Ph.D. (Nehru University, India, 1989); Darion Rapoza, Ph.D. (Chicago, 1990); Ashok K. Shetty, Ph.D. (All India Institute of Medical Science, India, 1990).

DIVISION OF ORAL SURGERY

Associate Professor: John C. Angelillo, D.D.S., M.D. (Duke, 1970), *Chief*.

Assistant Professor: Thomas A. McGraw, D.D.S. (Pennsylvania, 1985).

Assistant Clinical Professor: Edward A. Dolan, D.D.S. (Maryland, 1971).

Assistant Consulting Professor: George A. Walsh, D.D.S. (Georgetown, 1972).

DIVISION OF ORTHOPAEDIC SURGERY

Professor: James R. Urbaniak, M.D. (Duke, 1962), *Chief*.

Professors: Frank H. Bassett III, M.D. (Louisville, 1957); Donald E. McCollum, M.D. (Bowman Gray, 1953); James H. McElhane, Ph.D. (West Virginia, 1964), Experimental Surgery; James A. Nunley, M.D. (Tulane, 1973).

Associate Professors: John A. Feagin, M.D. (Duke, 1961); William E. Garrett, M.D., Ph.D. (Duke, 1976); Richard D. Goldner, M.D. (Duke, 1974); John M. Harrelson, M.D. (Duke, 1964).

Associate Consulting Professor: Ralph W. Coonrad, M.D. (Duke, 1947).

Assistant Professors: Robert D. Fitch, M.D. (Duke, 1976); Reginald Hall, M.D. (Duke, 1983); Stephen N. Lang, M.D. (Illinois, 1965); L. Scott Levin, M.D. (Temple, 1982); Terry R. Malone, E.D.D. (Duke, 1985); Salutario Martinez, M.D. (Havana Univ., 1961); William J. Richardson, M.D. (Eastern Virginia, 1977); Kevin P. Speer, M.D. (Johns Hopkins, 1985); T. Parker Vail, M.D. (Loyola, 1985).

Assistant Clinical Professor: William T. Hardaker, M.D. (Duke, 1973).

Assistant Research Professor: Barry S. Myers, M.D., Ph.D. (Duke, 1991).

Assistant Consulting Professors: Carl J. Basamania, M.D. (George Washington, 1984); Quinn H. Becker, M.D. (Louisiana State, 1956); Edward W. Bray III, M.D. (Med. Univ. of South Carolina, 1971); William J. Callison, M.D. (Vanderbilt, 1953); Rick D. Compton, M.D. (Ohio State, 1983); Edwin B. Cooper, Jr., M.D. (Duke, 1966); J. Lawrence Frank, M.D. (Duke, 1965); Stephen A. Grubb, M.D. (Northwestern, 1974); C. Robert Lincoln, M.D. (Med. Coll. of Virginia, 1960); William J. Mallon, M.D. (Duke, 1984); Ronald J. Neimkin, M.D. (Cornell, 1975); William S. Ogden, M.D. (Med. Coll. of Georgia, 1965); Theodore M. Pitts, M.D. (Yale, 1977); Edwin T. Preston, Jr., M.D. (Duke, 1960); Glydon B. Shaver, Jr., M.D. (Tennessee, 1961); Stephen L. Simpson, M.D. (Boston Univ., 1985); Bradley W. White, M.D. (Texas Southwestern, 1983).

Consulting Associates: Richard F. Bruch, M.D. (Illinois, 1972); Albert T. Jennette, M.D. (North Carolina at Chapel Hill, 1959); Ronald A. Pruitt, M.D. (Med. Coll. of Virginia, 1959); William A. Somers, M.D. (Duke, 1972).

Research Associates: Long-en Chen, M.D. (Peking Med. Coll., China, 1967), Ph.D. (Shanghai, 1983); Wen-ning Qi, M.D. (Peking Union Med. Coll., China, 1967); Anthony V. Seaber.

DIVISION OF OTOLARYNGOLOGY

Professor: William J. Richtsmeier, M.D. (Case Western Reserve, 1975), Ph.D. (Med. Coll. of Wisconsin, 1975), *Chief*.

Professors: Joseph C. Farmer, Jr., M.D. (Duke, 1962); William R. Hudson, M.D. (Bowman Gray, 1951).

Associate Professors: Samuel R. Fisher, M.D., (Duke, 1975); Patrick D. Kenan, M.D. (Duke, 1959).

Associate Medical Research Professor: John H. Casseday, Ph.D. (Indiana, 1970).

Assistant Professors: John T. McElveen, Jr., M.D. (North Carolina at Chapel Hill, 1978); Richard L. Scher, M.D. (Cincinnati, 1985); Debra L. Tucci, M.D. (Virginia, 1985).

Assistant Research Professors: Eric Javel, Ph.D. (Pittsburgh, 1972); David W. Smith, Ph.D. (Michigan, 1986); Christopher Van den Honert, Ph.D. (Case Western Reserve, 1979).

Assistant Consulting Professors: Beverly J. Adams, M.D. (Duke, 1977); Charles E. Clark III, M.D. (Michigan, 1968); Berrylin J. Ferguson, M.D. (Duke, 1980); Lynn A. Hughes, M.D. (Oklahoma, 1968); David J. Seel, M.D. (Tulane, 1948); Robert E. Taylor, M.D. (Alabama, 1976); C. Emery Williams, M.D. (Louisiana, 1963).

Adjunct Assistant Professors: Charles C. Finley, M.D. (North Carolina at Chapel Hill, 1983); Dewey T. Lawson, Ph.D. (Duke, 1972); Blake S. Wilson, B.S. (Duke, 1974).

Consulting Associates: Peter G. Chikes, M.D. (North Carolina at Chapel Hill, 1972); Edward V. Hudson, M.D. (Bowman Gray, 1962).

DIVISION OF PLASTIC AND MAXILLOFACIAL SURGERY

Professor: Donald Serafin, M.D. (Duke, 1964), *Chief*.
Professors: Robert M. Mason, D.M.D. (Kentucky, 1977), M.S.O. (North Carolina at Chapel Hill, 1979), Orthodontics; Galen W. Quinn, D.D.S. (Creighton, 1952), Orthodontics.
Associate Professors: John C. Angelillo, D.D.S. (Duke, 1970); Gregory S. Georgiade, M.D. (Duke, 1973).
Associate Clinical Professor: Ronald Riefkohl, M.D. (Tulane, 1972).
Associate Consulting Professor: Verne C. Lanier, Jr., M.D. (Vanderbilt, 1966).
Assistant Professors: James A. Hoke, D.D.S. (Ohio State, 1972), M.S. (Michigan, 1976), Dentistry; L. Scott Levin, M.D. (Temple, 1982); Edmond F. Ritter, M.D. (Washington Univ., 1984); Gregory L. Ruff, M.D. (Michigan, 1978).
Assistant Research Professor: Bruce M. Klitzman, B.S.E. (Duke, 1974), Ph.D. (Virginia, 1979).
Assistant Clinical Professor: Martha A. Keels, D.D.S. (North Carolina at Chapel Hill, 1984), M.S., Ph.D. (North Carolina at Chapel Hill, 1990), Dentistry.
Consulting Associate: James T. White, D.D.S. (Loyola, 1966), M.S. (North Carolina at Chapel Hill, 1976), Dentistry.

DIVISION OF UROLOGIC SURGERY

Professor: David F. Paulson, M.D. (Duke, 1964), *Chief*.
Professors: E. Everett Anderson, M.D. (Duke, 1958); Culley C. Carson III, M.D. (George Washington, 1971); Lowell R. King, M.D. (Johns Hopkins, 1956); Philip J. Walther, M.D., Ph.D. (Duke, 1975); George D. Webster, M.B., Ch.B. (Univ. Coll. of Rhodesia, 1968); John L. Weinerth, M.D. (Harvard, 1967).
Associate Consulting Professor: John H. Grimes, M.D. (Northwestern, 1965).
Assistant Professors: Andrew F. Meyer, M.D. (New York, 1969); Cary N. Robertson, M.D. (Tulane, 1977).
Assistant Research Professors: John W. Day, Ph.D. (Iowa, 1972); Karen S. Webb, Ph.D. (North Carolina at Chapel Hill, 1973).
Assistant Consulting Professors: Hector H. Henry II, M.D. (Tulane, 1965); Raymond E. Joyner, M.D. (Bowman Gray, 1968); Ignacio Sarmina, M.D. (Med. Coll. of Ohio, 1982); Earl L. Shook, Jr., M.D. (New York Med. Coll., 1952); Sigmund I. Tannenbaum, M.D. (Duke, 1975); Edwin M. Tomlin, M.D. (Tennessee, 1946); Wade S. Weems, M.D. (Duke, 1962).
Clinical Associate: Steven H. Herman, Ph.D. (Duke, 1977).
Consulting Associates: James A. Bergant, M.D. (Kansas, 1969); Alexander Maitland III, M.D. (Yale, 1955).
Medical Center Instructors: Robert W. Andrews, M.D. (Bowman Gray, 1980); Oscar W. Brazil, Jr., M.D. (Louisiana, 1961).

PROGRAM IN HEARING AND SPEECH DISORDERS

Associate Professors: Jennifer Horner, Ph.D. (Florida, 1977); Bruce A. Weber, Ph.D. (Illinois, 1966).
Assistant Clinical Professor: John E. Riski, Ph.D. (Florida, 1976).
Associates: Burton B. King, M.A. (Northwestern, 1955); Robert G. Paul, Ph.D. (Oklahoma, 1969).

Emeriti: D. Bernard Amos, M.D.; Lennox D. Baker, M.D.; Frank W. Clippinger, M.D.; Eugene D. Day, Ph.D.; John E. Dees, M.D.; Clarence E. Gardner, Jr., M.D.; Nicholas G. Georgiade, D.D.S., M.D.; J. Leonard Goldner, M.D.; Guy L. Odom, M.D.; William P. J. Peete, M.D.; Raymond W. Postlethwait, M.D.; Will C. Sealy, M.D.; James H. Semans, M.D.; William W. Shingleton, M.D.

Required Course

SUR-205. The required course in surgery, is given in the second year and consists of an eight week clinical clerkship. The primary goal is the presentation of those concepts and principles which characterize the discipline of surgery. The fundamental features which form the foundation of surgical practice are presented at seminars three times weekly. The subjects discussed include antisepsis, surgical bacteriology, wound healing, inflammation, fluid and electrolyte balance, shock, the metabolic response to trauma, biology of neoplastic disease, gastrointestinal physiology and its derangements, and blood coagulation, thrombosis, and embolism.

The students are divided into two groups, one at Duke and the other at the Veterans Administration Medical Center, and each works with two members of the surgical faculty. Students are assigned patients on the surgical wards for diagnosis and management, and clinical rounds are made three times weekly with the faculty. A full-time teaching resident is assigned for the course in order to provide the students with continuous and readily available

instruction at all times. A one hour session is devoted daily to demonstrations by the surgical specialties including neurosurgery, orthopaedics, otolaryngology, plastic surgery, and urology. The students attend a weekly session in experimental surgery, during which each student serves in rotation as the anesthesiologist, first assistant, and operating surgeon in performance of surgical procedures on experimental animals.

Electives

SUR-219C. Advanced General And Thoracic Surgery (VA Hospital). The student will function as a sub-intern in surgery. Special attention will be given to those subjects in surgery common to all medical practices. Patients will be assigned to the students who will assume primary responsibility for their care under the supervision of the faculty and residents. The major emphasis will be on physiologic and pathologic changes, diagnosis, indications for operation, and observation of surgical procedures. Prerequisite: permission of Dr. Wolfe. Weight: 8 Max: 3. *Wolfe*

SUR-221C. Surgical Specialties and Ophthalmology (VA Hospital). The student will attend selected conferences of all the surgical specialties and ophthalmology. Additionally, he will select two or three of these specialties in which to concentrate experience (on one service at a time) in the operating rooms, clinics, and wards of the VA Hospital. Pathophysiology, diagnosis, and treatment will be emphasized. Weight: 8 Max: 10. *Walther, Pollack, Moylan, Fisher, Turner, Harrelson, and Wolfe*

SUR-227C. Advanced Urologic Clerkship. The diagnosis, management, and surgical treatment of patients with urologic disorders will be stressed. Students will be afforded intimate association with the entire staff in the clinics, wards, and operating rooms and will participate in surgery. Cystoscopic and urographic diagnostic methods along with other techniques will be taught. Weight: 4 or 8 Max: 6. *Paulson, Anderson, King, Weinerth, Webster, Carson, Walther, and Robertson*

SUR-228C. Clerkship in Pediatric Urology. Designed to give an overview of urologic problems in the pediatric population. Will include patient contact and seminar material as well as ward and operating room experience in the diagnosis, treatment, and long-term follow-up of children with urologic disease. Weight: 4 Min: 1 Max: 2. *King*

SUR-230C. Seminar in Urologic Diseases and Techniques. Lecture/seminar course by members of the staff in Urology and Radiology providing an introduction to the spectrum of urologic diseases amplified by demonstration of urologic and radiologic diagnostic methodology. Clinical problems to be stressed include pediatric urology, obstructive uropathies, urinary calculi, male infertility, impotence, trauma, urodynamics, reconstructive urology, and urologic malignancies. Informal seminars given weekly. If permitted by the instructor, this clinical science course can be audited. Weight: 2 Min: 3 Max: 8. *Paulson, Anderson, King, Weinerth, Webster, Carson, Walther, Robertson, and Dunnick*

SUR-233C. Basic Neurosurgery Course. Disease conditions commonly encountered by neurosurgeons are presented. Clinical presentation of a disorder such as brain tumor or head injury is made by a member of the staff. Clinical features and plan of diagnostic investigation are stressed. The clinical disorder is used as a focal point from which to carry the presentation into the basic sciences that are related to the clinical problem. Prerequisites: student must have the approval of Dr. Cook to register for this course. Weight: 1 Min: 3 Max: 20. *Cook, Wilkins, Kramer, Oakes, Turner, and Friedman*

SUR-234C. Pediatric Neurosurgery. Survey of the major neurosurgical topics encountered in the pediatric age group. Emphasis will be given to the demonstration of clinical findings, necessary radiographic evaluation, and therapeutic alternatives in selected disease processes. Prerequisite: student must have approval of Dr. Fuchs to register for this course. Weight: 1 Min: 4 Max: 15. *Fuchs*

SUR-235C. Clinical Neurosurgery. The course is designed for those students with a career interest in one of the neurological sciences. Duties include the work up and care of inpatients, work up of clinic patients, assistance in the operating room, daily rounds, and night call. Weekly conferences are held in neurosurgery, neurology, neuropathology, and neuroradiology. There are also special lectures. Prerequisites: student must have the approval of Dr. Wilkins to register for this course. Weight: 4 or 8 Max: 4. *Wilkins, Nashold, Cook, Kramer, Fuchs, Turner, and Friedman*

SUR-236C. Intermediate Clinical Neurosurgery. This elective, intended as an intermediate experience between SUR 233C and SUR 235C, focuses on the clinical presentation of common neurosurgical disorders, radiographic evaluation, and therapeutic options including the indications and contraindications for surgical intervention. The student will work up one to three patients in the evening and assist at their operations the following day either once or twice per week and will attend the 8:00 a.m., Saturday, neurosurgical conference. Prerequisites: permission of instructor. Weight: 1 or 2 Max: 1. *Wilkins*

SUR-237C. Investigative Neurosurgery. The student is assigned a project relating to neurologic sciences and, within reason, is provided with technical help, recording equipment, and experimental animals necessary for its completion. Each student plans and executes his own individual project with the help of the neurosurgery staff. Attendance at weekly conferences is also required. Prerequisites: SUR 235C suggested. The student must have the approval of Dr. Wilkins to register for this course. Weight: 8 Max: 2. *Wilkins, Nashold, Kramer, Friedman, Turner, and Fuchs*

SUR-239C. Clinical Otolaryngology. This course will provide the student with a comprehensive survey of clinical otolaryngology. Duties will include participation in both outpatient clinic activities and inpatient care in addition to assisting in the operating room. The student will participate in ward rounds and in various conferences held by the division. Weight: 4 or 8 Max: 2. *Richtsmeier, Kenan, Cole, Farmer, Fisher, McElveen, and Scher*

SUR-240C. Otolaryngology Seminar. This conference and demonstration course will provide an introduction to a variety of clinical problems in otolaryngology. Lectures will be supplemented with case presentations illustrating problems encountered in this field. If permitted by the instructor, this clinical science course can be audited. Weight: 1 Min: 4 Max: 6. *Richtsmeier*

SUR-242C. Biological Basis of Hearing. An examination of the relation of anatomy and physiology of the central auditory system to auditory discriminations. Original papers on neuroanatomy, electrophysiology, and psychophysics of hearing will be read and discussed. Prerequisites: permission of instructor. If allowed by the instructor, this clinical science course can be audited. Weight: 3. *Casseday*

SUR-244C. Introduction Plastic, Reconstructive and Maxillofacial Surgery. This course is designed for students who may have a future interest in plastic surgery. Duties include the preoperative evaluation of patients, assisting in the operating room, making daily ward rounds, and participation in conferences. Weight: 4. *Serafin, Barwick, G. Georgiade, N. Georgiade, Riefkohl, and Ruff*

SUR-245C. Advanced Plastic, Reconstructive and Maxillofacial Surgery. This course is designed for students with a demonstrated interest in plastic and reconstructive surgery. Duties include active participation in the care of patients on the Resident Service. Emphasis is placed on preoperative evaluation, assisting in the operating room, making daily ward rounds, and participation in conferences. Students will also be expected to attend the Cleft Palate Board and resident clinics. Responsibilities also include participation in the care of acutely injured patients treated in the Emergency Room. Weight: 8 Max: 1. *Serafin, Barwick, G. Georgiade, N. Georgiade, Riefkohl, and Ruff (Clifford, Mason, Riski, Weber)*

SUR-246C. Clerkship in Plastic and Reconstructive Surgery. The student participates in evaluation and management of plastic surgery patients including preoperative assessment, surgical assistance, and postoperative follow-up in a private office and at Durham Regional Hospital. Daily seminars cover core topics such as skin and surgical techniques, wound healing, and scars. Prerequisite: permission of instructor. Weight: 4 Max: 1. *Serafin*

SUR-247C. Plastic Surgery Research. Students will be engaged in scholarly activities which are active, in-depth learning experiences related to microvascular, plastic, and/or reconstructive surgery. The students will be expected to design, execute, and analyze data and to formulate hypotheses and draw conclusions from their projects. Weight: 1-8 Max: 4. *Klitzman and Serafin*

SUR-255C. Directed Study in Speech/Language Pathology and Audiology. Individual directed study in selected topics concerning normal and abnormal hearing, language and speech functions. In consultation with a faculty member, each student will select one or more topics within the following areas: (a) the auditory system and hearing loss; (b) development and disorder of language and speech of children; (c) language and speech disorders of neurologically impaired adults (aphasia, dementia, neglect, dysarthria, dysphagia syndromes); (d) voice disorders and laryngectomy; (e) speech disorders secondary to cleft palate and other craniofacial anomalies; (f) stuttering. Emphasis on fundamentals of normal and abnormal function and principles of evaluation and management of disorders in each area. Prerequisite: permission of instructor. Weight: 1. *Weber, Horner, Riski, and King*

SUR-259C. General Principles of Orthopaedics. A full experience on the Orthopaedic Service with duties and responsibilities similar to a junior intern. Inpatient care, outpatient examination, and operating room experience are included. Individual or group discussions each day with attending staff/residents. The purpose of the course is to present broad concepts of orthopaedics to students planning general practice, pediatrics, allied surgical specialties or orthopaedics. Weight: 4 or 8 Max: 6. *Urbaniak, Clippinger, McCollum, Bassett, Harrelson, Hardaker, Nunley, R. Goldner, Garrett, Fitch, Lang, Richardson, Feagin, and Hall*

SUR-261C. Office and Ambulatory Orthopaedics. A full or part-time experience on the Orthopaedic Service with duties and responsibilities similar to a junior intern. Inpatient care, outpatient examination, and operating room experience are included. Individual or group discussions each day with attending staff. The purpose of the course is to offer clinical experience to students who have completed SUR 259C. Rotations will be similar to those of SUR 259C. Prerequisites: SUR 259C. Weight: 8 Max: 12. *Bassett, Clippinger, McCollum, Urbaniak, Coonrad, Lincoln, Lang, Frank, Harrelson, Hardaker, R. Goldner, Garrett, Nunley, Richardson, Feagin, Hall, Speer, and Vail*

SUR-267C. Introductory Clinic Course in Cerebral Palsy and Children's Orthopaedics. This introductory clinic course is arranged for those interested in neurological disease, pediatric orthopaedic problems, and related fields. This will give the student a working experience in the examination and evaluation of patients under clinical conditions which demonstrates both the individual and multidisciplinary group approach to the whole patient with complex neurologic and orthopaedic conditions as they affect both growth and development. Out-patients and in-patients are utilized for subject material. Staff personnel are readily available for individual discussion and seminars. Weight: 2 or 4 Max: 2. *Coonrad, Fitch, and cerebral palsy staff*

SUR-275C. Pediatric Cardiac Surgery. The student will become an active member of the surgical team caring for infants and children with congenital heart defects. Responsibilities will include ward work and participation during surgery. This student will be involved

in perioperative decision making and weekly formal didactic sessions will be provided. Weight: 2 Max: 2. *Ungerleider*

SUR-276C. Advanced Clerkship in Pediatric Surgery. This course is designed to familiarize the student with the whole range of surgical problems in children, but with emphasis on the pathophysiology of surgical and related problems in the newborn infant and the total care of the child with a malignancy. The student is encouraged to participate fully in the patient care aspects of the service and is considered an integral part of the patient care team. Although the course may be taken for the full eight weeks, it is felt that a four week experience is probably optimal for most students. It may be combined with other advanced surgical clerkships such as Surgery 299C or with four weeks of neonatology, Pediatrics 225C, or other courses depending on the interests of the student. Prerequisites: brief pre-enrollment interview with Dr. Keith Oldham. Weight: 4 or 8 Max: 2. *K. Oldham and Mahaffey*

SUR- 280C. General Surgical Oncology. The course is designed for the student interested in surgical oncology. The students will be involved in patient care with a specific surgeon, but in addition, will be expected to attend multidisciplinary conferences related to gastrointestinal and breast carcinoma. These multidisciplinary conferences involve medical and radiation oncology as well as surgical oncology. The student is also expected to evaluate surgical patients in an outpatient setting as well as participating in inpatient and operative patient care. This course is designed for students who have an interest in the basic sciences in relation to surgical oncology. Attendance at research conferences involved in the molecular and cellular biology of human cancers is also expected. Permission of instructor is required. Weight: 4 Min: 1 Max: 2. *Lyerly*

SUR-277C. Orthopaedic Research. Individual projects are assigned for completion during a limited period of time. A student works with an investigator in the orthopaedic laboratory either at Duke Medical Center or the Durham Veterans Administration Hospital. Clinical investigation studies are also available at both institutions. Weight: 8 Max: 4. *Urbaniak, Bassett, Harrelson, R.. Goldner, Garrett, orthopaedic senior staff, and house staff*

SUR-281C. Introduction to Fractures and Musculoskeletal Trauma. Students will participate in the emergency management of patients through the Duke Emergency Room or through Durham Regional Hospital. Principles of fractures in trauma will be given throughout the week at specified times. Attendance at Fracture Conference will be required on Wednesdays and Saturdays at 7:00 a.m. in addition to two nights on call in the emergency room of either Duke University Medical Center or Durham Regional Hospital. Seeing patients in the Out-Patient Clinic one day per week is required. Entire orthopaedic staff at Duke or Durham Regional Hospital supervised by Dr. Urbaniak at Duke, Dr. Lincoln at Durham Regional Hospital. Weight: 3 Max: 4. *Urbaniak and Lincoln*

SUR-282C. Advanced Surgery—Emphasis Cancer. Advanced concepts in surgical oncology will be presented in seminars as well as in ward, tumor clinic, and operating room experiences. Seventy-five percent of student time will be devoted to clinical cancer management and related basic science topics. The remaining twenty-five percent will relate to surgery in general. Weight: 8 Min: 2 Max: 5. *Seigler, Leight, Meyers, and Wolfe*

SUR-283C. Advanced Surgery—Emphasis Cardiovascular/Thoracic. Advanced concepts in surgery will be presented in seminars and in ward, clinic, and operating room experiences. Fifty to seventy-five percent of the time will be devoted to cardiovascular/thoracic surgery and related basic topics and the remainder to surgery generally. Weight: 8 Min: 2 Max: 5. *Sabiston, Jones, Lowe, Smith, Ungerleider, Van Trigt, Wolfe, and Young*

SUR-284C. Advanced Surgery—Emphasis Transplantation. Advanced concepts in surgery will be presented in seminars and in ward, clinic, and operating room experiences. Fifty percent of the time will be devoted to clinical transplantation of the kidney, liver,

pancreas, and related basic topics. The remainder of the time will be spent on surgery, generally. Weight: 8 Max: 5. *Bollinger, McCann, Meyers, Stickel, Weinerth, and Vernon*

SUR-299C. Advanced Surgical Clerkship. This course is structured to provide the student with a comprehensive approach to surgical disorders. Each student will work in the clinics, on the wards, and in the operating rooms side by side with one senior surgeon to be selected from the approved list below. Weight: 5 or 10. *Sabiston, Akwari, Bollinger, Douglas, G. Georgiade, Glower, Grant, Iglehart, Jones, Leight, Lowe, Lyerly, Meyers, McCann, Oldham, Pappas, Peete, Seigler, Smith, Stickel, Ungerleider, Van Trigt, Vernon, Wolfe, and Young*

SUR-300C. Surgical Critical Care. The course is designed to broaden the student's knowledge and experience in dealing with critically ill patients. Under supervision, students will function as sub-interns in the Surgical Intensive Care Unit. Scheduled activities include daily lectures by the SICU attending staff and twice-daily SICU rounds. Through these experiences, students become familiar with critical care topics including cardiovascular resuscitation and support, ventilator management, hemodynamic assessment, prevention and management of nosocomial infections, and monitoring and support. Each student is responsible for participating actively in the care of at least one critically ill patient at a time. Students will be formally evaluated by the Critical Care Housestaff and the attending physician. Weight: 5 Min: 2 Max: 4. *Reed, Moylan, and Sladen*

SUR-301C. Emergency Department Surgical Care. Students desiring additional experience working with care of emergency surgical patients will be assigned to the Emergency Department one night per week for each credit desired. They will participate in the diagnosis and care of acute and traumatic surgical emergencies. Weight: 1-3 Max: 8. *Wellman*

SUR-303C. Trauma Service. This course is designed to provide students interested in trauma care with further experience both in the Emergency Department and on the Inpatient Trauma Service. The course will emphasize both triage and resuscitation for major and minor emergency problems in the Emergency Department and also pre- and postoperative care on the Inpatient Trauma Service. The student will have a full-time experience by assuming duties and responsibilities similar to a junior intern. Emphasis will be placed on developing skills in the care of patients with multisystem injuries in the Emergency Department, Inpatient Service, and Operating Room. Students will work in conjunction with the attending staff and the residents on the Trauma Service. Weight: 4 Max: 2. *Moylan, G. Georgiade, Pappas, and Reed*

SUR-304C. Nutrition in the Hospitalized Patient. This course is designed to acquaint students with the techniques of nutritional assessment including somatic protein, visceral protein mass, body fat mass, immune competence, and metabolic balance studies. Students will learn to determine basal energy expenditure and nitrogen requirements. The metabolic effects of acute and chronic starvation as well as stress and infection and the role played by these events in the hospital course of patients will be studied. Emphasis will be placed on techniques of nutritional support including routine and specialized hospital diets, routine and modular tube feeding diets, peripheral intravenous protein sparing and total parenteral nutrition. At the completion of the course, students will have a thorough grasp of clinical nutrition and be able to apply specialized oral diets, tube feeding diets, and intravenous nutrition. If permitted by the instructor, this clinical science course can be audited. Weight: 1 Min: 3 Max: 8. *Grant*

Special Interdisciplinary Course

IND-300C. Interdisciplinary Seminar in Medical-Legal-Ethical Issues. The seminar will be composed of students in approximately equal number from the Medical, Divinity, and Law Schools and will explore important medical, legal, and ethical features of current issues, e.g., transplantation, euthanasia, abortion. Faculty and resource persons from all three schools will participate in the seminar. Up to four introductory sessions in the fall semester

for all participating students and faculty will be concluded with arrangement of interdisciplinary terms and selected topics. Student teams will meet during the winter and consult at intervals with faculty. All semester participants will re-assemble for a series of weekly meetings ending in mid-March to present and discuss the topics researched. Any topics properly focused may be considered. Course covers fall section 82 and spring section 81. If permitted by instructor, this course can be audited. Weight: 2 Max: 6. *Gianturco (Medical), Shimm (Law), Smith (Divinity) and other faculty members from all three schools*

Special Interdisciplinary Training Programs

BEHAVIORAL NEUROSCIENCES STUDY PROGRAM (BSP-301B)

PROGRAM DIRECTOR: Dr. Everett Ellinwood

This study program is designed to help third year medical students obtain an integrative understanding of the basic processes underlying normal and pathological human and laboratory animal behavior. The course and preceptorship offerings familiarize students with significant developments in the behavioral neurosciences, investigative methodology used to examine human behavior and its neurobiological underpinnings, and the application of these findings to medicine. As an example, they are provided with the neuroanatomical, histochemical, neuroimmunological, neuropharmacological, and neurobehavioral basis of prescribing anxiolytics, antidepressants, and other neurotropic drugs.

Students are encouraged to select an area of research concentration and then arrange to match their interests with a faculty member as a research preceptor by discussing the array of options with a study program director. They are given the opportunity to focus on some determinant of human behavior which may include neurobiological, developmental, or psychosocial factors. Students may choose to spend a significant portion of their time in a closely supervised laboratory with associated library research in an area of the student's interest resulting in a published report of the work. Specific science interests can be augmented through seminars, guided readings, and appropriate courses providing a greater familiarity with current issues in the biobehavioral sciences. The following course work is required of all students: PSC 223B Neurobehavioral Basis of Behavior.

The following courses, although not required, are recommended for consideration: PSC-360B Neuropharmacology, PHR-372B Cellular Endocrinology; NBI-270B Neurobiology; PSC-213B Human Development I. Birth through Adolescence; PSC-215B Comparative Personality Theory.

Alternatives to the intensive laboratory research concentration are also offered. In addition to courses in the Department of Psychiatry, students may take courses given in the Medical and Graduate Schools.

FACULTY: Garth Bissette, Ph.D.; Dan G. Blazer, M.D., Ph.D.; Everett H. Ellinwood, Jr., M.D.; Linda K. George, Ph.D.; Jau-Shyong Hong, Ph.D.; K. Ranga Krishnan, M.B.B.S.; Cynthia M. Kuhn, Ph.D.; James E. Lee, M.D.; David J. Madden, Ph.D.; Roy J. Mathew, M.B.B.S., MRC; Saul M. Schanberg, M.D., Ph.D.; Susan S. Schiffman, Ph.D.; Rochelle D. Schwartz, Ph.D.; Richard S. Surwit, Ph.D.; Richard D. Weiner, M.D., Ph.D.; Redford B. Williams, M.D.

BIOMEDICAL ENGINEERING STUDY PROGRAM (BES-301B)

PROGRAM DIRECTORS: Dr. Peter K. Smith and Dr. James H. McElhaney

This interdepartmental study program is designed to provide third year students with an opportunity to perform basic science research in the broad area of biomedical engineering. The program is designed to provide research opportunities to students interested in the quantitative understanding of the physiology of organs and organ systems. The majority of the faculty have research laboratories which investigate these areas at the macroscopic level. The course of study usually emphasizes either the employment of whole animal models or in vitro simulation of disease states. The development and employment of new instrumentation may be a component of the research effort, but not its exclusive objective. Emphasis in the student experience is placed upon the teaching of the quantitative method of under-

standing biological systems. The student is expected to learn to formulate hypotheses regarding biologic systems, develop appropriate methods to test such hypotheses, and use statistical methods to resolve the information obtained. Each student selects a faculty preceptor in consultation with the program director(s) and an individual research plan is developed. Students who wish to enter this program are not required to have an engineering background.

FACULTY: Roger C. Barr, Ph.D.; Robert D. Fitch, M.D.; John A. Feagin, M.D.; William E. Garrett, M.D., Ph.D.; Donald D. Glower, M.D.; Bruce M. Klitzman, Ph.D.; Bruce J. Leone, M.D.; L. Scott Levin, M.D.; James E. Lowe, M.D.; James H. McElhaney, Ph.D.; Barry S. Myers, M.D., Ph.D.; Ares D. Pasipoularides, M.D., Ph.D.; Theo C. Pilkington, Ph.D.; Robert Plonsey, Ph.D.; Debra A. Schwinn, M.D.; Peter K. Smith, M.D.; William M. Smith, Ph.D.; Paul V. Suhocki, M.D.; George A. Truskey, Ph.D.; Ross M. Ungerleider, M.D.; James R. Urbaniak, M.D.; Peter Van Trigt, III, M.D.; Olaf T. von Ramm, Ph.D.

BIOMETRY AND MEDICAL INFORMATICS STUDY PROGRAM (BMS-301B)

PROGRAM DIRECTOR: Dr. William E. Wilkinson

This study program offers students the opportunity to explore, in the context of a biomedical application, one or more of the basic disciplines by which data are collected, stored and analyzed, hypotheses are constructed, and knowledge is integrated. These core disciplines include: biostatistics, database methods, decision theory, epidemiology, modeling, simulation, artificial intelligence, and systems development. The emphasis, therefore, is on study and research into the methodological principles of biometry and medical informatics which are involved in biomedical problem-solving situations rather than on the area of biomedical science in which the application occurs.

Because of the multidisciplinary nature of this program, a student may either select a preceptor from one of the core biometry and medical informatics laboratories or two faculty preceptors. (In the latter case, a discipline preceptor has a background in biometry, medical informatics, or epidemiology; an applications preceptor has a background in a medical basic science or clinical science area and is involved with a project utilizing one of the disciplines that constitute biometry and medical informatics.) The student, together with the faculty preceptors, designs an appropriate study plan which concentrates on one or two core disciplines. This plan consists of the following three components.

Individual research project: Under the supervision of the discipline and applications preceptors, students participate in an individual research experience which constitutes the major component of the study program. This experience is structured to provide an in-depth exposure to the use of techniques from the core discipline to address a real world biomedical problem.

An overview seminar exposes each student to the vocabulary and the basic principles and concepts of each of the core disciplines. In addition to this required course, each student is expected to acquire some depth of knowledge in the core disciplines chosen for concentration through a selection of two or three *discipline-specific courses*:

BMI 211B. Probability and Statistical Inference

BMI 212B. Design of Etiological, Clinical and Experimental Studies

BMI 213B. Research Data Management and Statistical Computing

BMI 217B. Clinical Decision Analysis

BMI 221B. Statistical Methods in Human Genetics

BMI 233B. Biomedical Uses of Computers

BMI 234B. Artificial Intelligence in Medicine

CFM 240B. Epidemiologic Methods in Primary Care Research

CPS 241. Data Base Methodology

Throughout the year, students and faculty members meet regularly to review ongoing research in the core disciplines. Students are expected to present their work in this context as a means of developing presentation skills and obtaining input from investigators who are not directly involved in their project.

Applications Preceptors: Any faculty member with an appointment in a Medical Center department and a laboratory involving applications of biometry and medical informatics can be an applications preceptor.

FACULTY: Craig A. Beam, Ph.D.; Scott R. Brazer, M.D., M.H.S.; W. Eugene Broadhead, M.D., Ph.D.; Robert M. Califf, M.D.; Deborah V. Dawson, Ph.D.; Elizabeth R. DeLong, Ph.D.; David T. Durack, M.D., D. Phil.; W. Edward Hammond, Ph.D.; Frank E. Harrell, Jr., Ph.D.; Kerry L. Lee, Ph.D.; David B. Matchar, M.D.; Lawrence H. Muhlbaier, Ph.D.; Edward L. C. Pritchett, M.D.; David B. Pryor, M.D.; L. Richard Smith, Ph.D.; Galen S. Wagner, M.D.; William E. Wilkinson, Ph.D.

BIOPHYSICS STUDY PROGRAM (BPP-301B)

PROGRAM DIRECTOR: Dr. G. Allan Johnson

This interdepartmental program provides an opportunity for medical students in the elective year to participate in research areas of basic and clinical medicine where quantitative and engineering methods are employed. The range of subject material included in the program is broad, ranging from the development of instrumentation to theoretical studies on chemical and physical mechanisms in biomedical systems. Some example areas are the development and application of new imaging techniques and the application of computer simulation to the study of biochemical and physiological systems.

Each student selects a faculty preceptor in consultation with the program directors and designs an individual plan in cooperation with the preceptor and directors. The primary emphasis of each student's plan is expected to be research. Students may, however, also be advised to take an existing course or to set up a tutorial with a faculty member to fill in deficient areas or to acquire needed quantitative or engineering skills. Depending on the subject area selected, a student may initiate a new research project of limited scope or take over a well-defined part of an existing project. Students are expected to produce some form of written summary of their work, possibly (but not necessarily) a paper suitable for publication in a scientific journal.

Students taking this program should have some prior training or experience in one or more of the following areas: mathematics, computer science, physics, chemistry, or engineering (electrical, mechanical, biomedical, etc.).

FACULTY: H. Cecil Charles, Ph.D.; Mark W. Dewhirst, D.V.M., Ph.D.; James T. Dobbins III, Ph.D.; Carey E. Floyd, Ph.D.; Laurence W. Hedlund, Ph.D.; Ronald J. Jaszczak, Ph.D.; Randy L. Jirtle, Ph.D.; G. Allan Johnson, Ph.D.; James R. MacFall, Ph.D.; James R. Oleson, M.D., Ph.D.; H. Dirk Sostman, M.D.; Leonard D. Spicer, Ph.D.; Michael R. Zalutsky, Ph.D.

CARDIOVASCULAR STUDY PROGRAM (CVS-301B)

PROGRAM DIRECTOR: Dr. Harold C. Strauss

This interdepartmental study program is designed to provide third year medical students with an in-depth basic science research experience in one area of the broad discipline of cardiovascular science. The program is directed at those students potentially interested in a career in cardiovascular research. Faculty members in this study tract come from numerous departments including biochemistry, cell biology, immunology, pathology, and pharmacology. Students who elect this study program undertake a research project in a laboratory under the guidance of a faculty preceptor. In addition, students are encouraged to take course work each term to complement their research interests. Because a wide range of research opportunities is available, course work is individually tailored by the faculty preceptor to the interests of the student.

FACULTY: Page A. W. Anderson, M.D.; Robert M. Bell, Ph.D.; G. Vann Bennett, M.D., Ph.D.; Perry J. Blackshear, M.D., Ph.D.; Marc G. Caron, Ph.D.; Frederick R. Cobb, M.D.; Stephen M. Denning, M.D.; Samuel E. George, M.D.; Augustus O. Grant, M.B., Ch.B.; Joseph C. Greenfield, Jr., M.D.; Diane L. Hatchell, Ph.D.; Barton F. Haynes, M.D.; Raymond E. Ideker, M.D., Ph.D.; Bruce M. Klitzman, Ph.D.; William E. Kraus, M.D.; Robert J. Lefkowitz, M.D.; Ann LeFurgey, Ph.D.; Melvyn Lieberman, Ph.D.; Anthony R. Means, Ph.D.; Claude A. Piantadosi, M.D.; Keith A. Reimer, M.D., Ph.D.; David C. Sane, M.D.; Frederick H. Schachar, Ph.D.; Debra A. Schwinn, M.D.; Madison S. Spach, M.D.; C. Frank Starmer, Ph.D.; Deborah A. Steege, Ph.D.; Gary L. Stiles, M.D.; Harold C. Strauss, M.D.; Kenneth A. Taylor, Ph.D.; Antonius M. J. VanDongen, Ph.D.; Xiao-Fan Wang, Ph.D.; A. Richard Whorton, Ph.D.

CELL AND REGULATORY BIOLOGY STUDY PROGRAM (CRB-301B)

PROGRAM DIRECTORS: Dr. George M. Padilla and Dr. Steven R. Vigna

The CRB program is based on the application of contemporary experimental approaches of cell biology and genetics to the study of regulatory mechanisms in health and disease. It seeks to bridge the gap between research at the cellular/molecular and tissue/organ level of organization.

Research areas represented in the CRB program fall into four broad categories:

- *Molecular properties and actions of peptide hormones, growth factors and their receptors.* This category includes studies on membrane biology, ligand-receptor interactions, and signal transduction; molecular mechanisms of insulin action and related growth factors (EGF and PDGF); and mechanisms of action of regulatory peptides on gastrointestinal target organs.

- *Genetic and biochemical regulation of membrane function, cytoskeletal elements, intracellular motility, and macromolecular trafficking.* In this category are studies on the motor complexes which drive organelle movements within cells during endocytosis, exocytosis, and axonal transport; intracellular function of unconventional myosins encoded by *abm* genes; biochemical and genetic definition of resident and transient Golgi proteins; and regulation of nucleocytoplasmic trafficking.

- *Genetic regulation of cell proliferation, growth, and development.* Research in this category includes the biochemical and functional properties of the recessive retinoblastoma oncogene; hormonal regulation of malignant cell growth; the molecular basis of cytokinesis; the role of fetal and placental hormones in the regulation of fetal growth and oogenesis; molecular basis of morphogenetic changes using genetic and transgenic methods; and the role of cyclins in mitotic and meiotic events in relation to cell cycle specific kinases.

- *Regulation of integrated physiological processes.* In this category are investigations on the role of atrial natriuretic factors in blood volume and arterial pressure regulation; the role of intracellular second messengers in ionic and metabolic regulation; regulation of chloride channels in epithelial cells; regulatory mechanisms of tissue oxygen concentration and oxidant damage; organization and control of intermediary metabolism pathways; neural regulation of gonadotropin function; and genetic regulation of intermediary metabolism in response to metabolic demands on striated muscle (myocytes).

The major emphasis of the CRB program is on student-generated, independent study/research projects conducted in a close association with a faculty preceptor. Students are encouraged to enroll in basic science courses or relevant clinical offerings which contribute to their research projects or their future career goals. The research colloquia and self-learning course offerings, as described below, are equally important components of the CRB program.

For all students, the program consists of the following:

Individual Tutorial (CBI 219). This is carried out under the supervision of a faculty preceptor selected by each student with the approval of the program directors. Students are expected to complete their tutorial arrangements before entering the program. The program directors direct the students to appropriate faculty preceptors and evaluate the proposed research projects.

Topics in Cell and Regulatory Biology (CBI 220). Basic science principles and their application to clinical situations are considered in this course. Focus is on integrated analyses of regulatory mechanisms from the cellular to the organ levels of organization. Faculty led seminars and interactive discussion, utilizing problem based format when appropriate, are held at weekly intervals to consider topics which reflect the academic and research interests of the CRB participants.

Lecture Courses. Elective courses pertinent to this program include the following courses:

CBI 217. Membrane Transport

CBI 230. Cytoskeleton and Cell Motility

CBI 232. Extracellular Matrix and Cell Adhesion

CBI 259. Molecular Biology I. Protein and Membrane Structure/Function

CBI 269. Advanced Cell Biology
CBI 414. The Human Embryo
CBI 417. Membranes, Receptors and Cellular Signalling
CBI 418. Reproductive Biology

Self-Learning Activities. The CRB Program is designed to permit students to participate in self-study activities that contribute to their immediate and long-term medical career needs. The program directors assist students in designing individual study/research programs to fulfill their academic goals in accordance to the rules and regulations of the elective third year.

Colloquia and Research Presentations. An important component of this program is a series of research colloquia scheduled through the academic year. At the beginning of the fall semester, students give a brief presentation on their proposed research to the CRB participants. This presentation and a short research report is a formal requirement of all participants. Toward the end of spring semester, students present their research results before the group in the form of a platform presentation.

Research Reports. Coincident with the research colloquia, students are required to submit two written reports to the program directors on their research projects. The preliminary report is submitted before the end of the fall semester. It consists of a brief review of the literature, a discussion of the hypothesis to be tested, specific aims of the proposed research, and a brief assessment and justification of the methodologies that are to be employed. A midyear grade is based on the initial research colloquium and preliminary report. The final report, submitted towards the end of the spring semester, is written in the form of a research paper being submitted for publication. It should include a more extensive review of the literature and an evaluation and discussion of the results obtained. The colloquia and research reports provide an opportunity for medical students to develop communication and presentation skills for their biomedical careers.

FACULTY: Onyekwere E. Akwari, M.D.; Nels C. Anderson, Jr., Ph.D.; Bruce A. Benjamin, Ph.D.; Peter B. Bennett, Ph.D., D.Sc.; Perry J. Blackshear, M.D., Ph.D.; J. Joseph Blum, Ph.D.; Marc G. Caron, Ph.D.; Thomas G. Chappell, Ph.D.; Jonathan A. Cohn, M.D.; Laura I. Davis, Ph.D.; Arturo De Lozanne, Ph.D.; William Dittman, M.D.; Marc K. Drezner, M.D.; J. Gregory Fitz, M.D.; Michael Freemark, M.D.; William E. Garrett, M.D., Ph.D.; Thomas W. Gettys, Ph.D.; Yusuf A. Hannun, M.D.; John M. Harrelson, M.D.; Jonathan M. Horowitz, Ph.D.; Claude L. Hughes, M.D., Ph.D.; Christine M. Hunt, M.D.; James D. Iglehart, M.D.; Daniel P. Kiehart, Ph.D.; William E. Kraus, M.D.; Cynthia M. Kuhn, Ph.D.; Rodger A. Liddle, M.D.; Kenneth S. McCarty, Sr., Ph.D.; Tobias Meyer, Ph.D.; Terry O'Halloran, Ph.D.; George Padilla, Ph.D.; Patricia Saling, Ph.D.; David W. Schomberg, Ph.D.; Michael P. Sheetz, Ph.D.; Shirish Shenolikar, Ph.D.; Katherine I. Swenson, Ph.D.; Ian L. Taylor, M.D., Ph.D.; Margaret Titus, Ph.D.; E. Lee Tyrey, Ph.D.; Steven R. Vigna, Ph.D.; David K. Walmer, M.D., Ph.D.

IMMUNOLOGY STUDY PROGRAM (ISP-301B)

PROGRAM DIRECTOR: Dr. Frances E. Ward

This program is designed for students whose career goals lie in one of the many clinical specialties that interface broadly with immunology, allergy-immunology, infectious diseases, rheumatology, hematology, transplantation, and oncology. A basic but thorough introduction to immunology is developed in MIC 291B, which also emphasizes critical discussion of original research papers. A further and more clinically oriented analysis is provided in the core course Medical Immunology, MIC 330B, which emphasizes the role of immunologic mechanisms in various human disease states. Each student chooses a faculty preceptor with whom to work on an original research project. It is encouraged that the student not be merely injected into the continuum of the preceptor's research interests, but rather that an individual project be developed which can be completed during the study program. The primary goals of the program are to encourage and develop the student's own creativity, to expose him or her to the research interests and philosophies of the entire Department of Immunology, and to help gain a useful personal perspective on current immunologic thought with an emphasis on clinical relevance. The student's efforts and time are generally divided as follows:

Preceptorship. The major emphasis of the program during which the student functions much like a graduate student in the Department of Immunology. (30 hours or more per week)

Comprehensive Immunology (MIC 291B). An in-depth course in the basic concepts of immunology. Analysis of antigens and antibodies is followed by an emphasis on the organization and cellular and molecular aspects of the immune system, its regulation and effector mechanisms. (4 hours per week, fall term)

Medical Immunology (MIC 330B). A brief review of basic concepts of immunology is followed by in-depth discussions of the role of immune mechanisms in the pathogenesis and treatment of human diseases. Principle emphasis is placed on immune deficiency diseases, hypersensitivity, alloimmunity, transplantation, infectious diseases, autoimmunity, tumor immunology, and immunohematology. When applicable, the classes include patient presentations and laboratory demonstrations. The course meets daily permitting each disease state to be covered in considerable depth. (5 hours per week, spring term)

Seminars for Research Progress. Throughout the year, fellows and students in the department present brief informal seminars on their ongoing research. The discussion that follows is of great help to the presenter and allows the student to observe and participate in critical analysis of research before it is at the publication or formal seminar stage. (1 hour per week)

Immunology Department Seminars. A series of formal seminars by department faculty and visiting scientists. (1-2 hours per week)

Additional Course Work. The student may elect to take any of several courses in immunology and related fields but is generally discouraged from excessively diluting his laboratory experience.

FACULTY: Yair Argon, Ph.D.; Andrew E. Balber, Ph.D.; Robert C. Bast, Jr., M.D.; R. Randal Bollinger, M.D., Ph.D.; Dani P. Bolognesi, Ph.D.; Rebecca H. Buckley, M.D.; Ronald B. Corley, Ph.D.; Jeffrey R. Dawson, Ph.D.; Carolyn Doyle, Ph.D.; Russell P. Hall III, M.D.; Barton F. Haynes, M.D.; Donna D. Kostyu, Ph.D.; Michael S. Krangel, Ph.D.; Joanne Kurtzberg, M.D.; M. Louise Markert, M.D., Ph.D.; Thomas J. Palker, M.D.; David S. Pisetsky, M.D., Ph.D.; Wendell Rosse, M.D.; Alfred P. Sanfilippo, M.D., Ph.D.; Hiliard F. Seigler, M.D.; Ralph Snyderman, M.D.; Frances E. Ward, Ph.D.

INFECTIOUS DISEASES STUDY PROGRAM (IDP- 301B)

PROGRAM DIRECTOR: Dr. Thomas G. Mitchell

Knowledge of infectious diseases is relevant to care of patients of all ages and in each clinical specialty from surgery, pediatrics, and medicine to obstetrics-gynecology and family medicine. This study program is designed to provide students with the opportunity to directly explore infectious diseases in a laboratory setting coupled with lecture/seminar courses designed to provide some breadth of knowledge of the host, microorganism, and their interactions. The goals of the program are to instill a critical assessment of information, to provide the opportunity for creative acquisition of data, to encourage independent thinking, and to provide insight into modern technology and the interrelationship of clinical infectious diseases with basic microbiology and immunology.

Each student selects a faculty preceptor with whom to work on an original research project. The student is expected to develop her or his own project within the framework of an existing laboratory, but designs her or his own experiments, critically assesses the relevant literature, learns to evaluate data, and has the opportunity to solve the problems associated with the project. Appropriate guidance and assistance is provided by the faculty and others within the laboratory setting.

- *Preceptorship.* This is the major emphasis of the program with students functioning essentially as graduate students. 30 hours or more per week.

- *Courses.* During the fall term, students are required to take one course, Principles of Infectious Disease (MIC 301B). This course provides discussion of the basic biology of a broad spectrum of microorganisms, the diseases they cause, and the host response to these infections. The first eight weeks of the term are devoted to bacterial infections and are organized by organ system. In the second eight weeks, viral diseases are presented ranging from intrauterine infections to oncogenes. During the spring term, students are required to take either Medical Immunology (MIC 330B) or Virology and Viral Oncology (MIC 252B), the selection being determined by the student's laboratory research interests.

- **Seminars.** Students in the Infectious Diseases Study Program attend a weekly seminar in which faculty members, fellows, and students present their ongoing research. Such presentations enable the student to observe and participate in critical analysis of research before it reaches the publication stage.

- **Additional Course Work.** Although other basic science electives in microbiology and immunology may be taken upon approval by the program director, the student is discouraged from excessively diluting her or his laboratory experience.

FACULTY: Dani P. Bolognesi, Ph.D.; Rebecca H. Buckley, M.D.; Vickers Burdett, Ph.D.; Bryan R. Cullen, Ph.D.; Mariano A. Garcia-Blanco, M.D., Ph.D.; Donald L. Granger, M.D.; John D. Hamilton, M.D.; Jonathan M. Horowitz, Ph.D.; Wolfgang K. Joklik, D.Phil.; Jack D. Keene, Ph.D.; Kenneth Kreuzer, Ph.D.; Roger J. Kurlander, M.D.; Joseph R. Nevins, Ph.D.; John R. Perfect, M.D.; David J. Pickup, Ph.D.; J. Brice Weinberg, M.D.; Kenneth H. Wilson, M.D.

MOLECULAR AND CELLULAR BASIS OF DIFFERENTIATION STUDY PROGRAM (MCD-301B)

PROGRAM DIRECTORS: Dr. Kenneth S. McCarty, Sr. and Dr. Sheila Counce

This study program is designed to provide an opportunity for third year medical students to spend a year interacting with a group of basic science faculty who utilize the concepts of molecular biology as applied to problems of differentiation. The primary objective is to present basic concepts including: (a) the organization and retrieval of genetic information; (b) hormonal regulation of gene expression; (c) relation of time, space, and pattern in developing systems; and d) tissue interactions in morphogenesis and differentiation. The organization of genetic information includes evidence of the mechanism of gene amplification in development and drug resistance, recent concepts regarding enhancer modification of hormone response, and specific examples of hormone induced gene expression. The mechanism(s) involved in cell-cell and cell-matrix interactions in differentiation are reviewed. The following courses form the background subject material:

- **BCH 320B Cell Differentiation In Development And Disease.** This is an introduction to gene structure and information retrieval in eukaryotes. Chromosome organization and mRNA transcription is reviewed using cDNA probes to test a number of new concepts of chromosome inactivation, gene amplification, and the impact of nucleocytoplasmic interactions on the regulation of differentiation.

- **BCH 321B Hormone And Tissue Interactions In Differentiation And Disease.** Hormones and other biochemical signals involved in the regulation of the differentiated state are discussed in terms of the new biotechnology used to elucidate mechanisms of information transfer and gene control at the level of chromatin. Cell-cell, cell-matrix, and hormonal interactions are considered as control elements in development and differentiation. Interactions involving the cell surface, the basal lamina, and extracellular matrix are discussed in terms of differentiation of limb bud, pancreas, lymphocyte, and neural tissue.

- **Conferences.** Conferences include a critical examination of recent papers on hormone control of sex differentiation, ectopic hormone biosynthesis, and endocrine related diseases and are designed as an extension of the courses described above.

- **Procedures.** Upon the selection of this program the directors assist students in selection of a mentor. After a discussion of the student's interests and expectations for the third year, the program directors suggest a number of possible mentors. After meeting with potential mentors to determine a preliminary selection, a program director meets with both the student and the selected mentor to discuss the proposed research. In this selection it is suggested that students also confer with former students for suggestions. The student then prepares a brief written outline of the meeting with copies submitted to both the mentor and director. As the research progresses, the student presents a progress report in the form of an informal seminar to the members of the program. At the end of the year a final seminar and written report are presented and, hopefully, a poster is submitted to the AOA symposium.

FACULTY: Yair Argon, Ph.D.; Robert M. Bell, Ph.D.; G. Vann Bennett, M.D., Ph.D.; Patrick J. Casey, Ph.D.; Joseph M. Corless, M.D., Ph.D.; Sheila Counce, Ph.D.; Sharyn A. Endow, Ph.D.; Harold P. Erickson,

Ph.D.; Carol A. Fierke, Ph.D.; Stephen Garrett, Ph.D.; Yusuf A. Hannun, M.D.; Michael S. Hershfield, M.D.; Edward W. Holmes, M.D.; Tao-Shih Hsieh, Ph.D.; Bernard Kaufman, Ph.D.; Cynthia M. Kuhn, Ph.D.; Robert J. Lefkowitz, M.D.; Virginia A. Lightner, M.D., Ph.D.; Elwood A. Linney, Ph.D.; Kenneth S. McCarty, Jr., M.D., Ph.D.; Kenneth S. McCarty, Sr., Ph.D.; Paul L. Modrich, Ph.D.; Joseph R. Nevins, Ph.D.; Keith L. Parker, M.D., Ph.D.; David C. Richardson, Ph.D.; Jane S. Richardson; Patricia Saling, Ph.D.; Michael P. Sheetz, Ph.D.; Theodore A. Slotkin, Ph.D.; Leonard D. Spicer, Ph.D.; Deborah A. Steege, Ph.D.; Gary L. Stiles, M.D.; Margaret A. Titus, Ph.D.

NEUROBIOLOGY AND VISUAL SCIENCES STUDY PROGRAM (NVS-301B)

PROGRAM DIRECTORS: Dr. Nell Beatty Cant and Dr. Diane L. Hatchell

The Neurobiology and Visual Sciences Study Program offers the opportunity to study basic sciences by focusing on the nervous system, including the visual system. Areas of study include neuroanatomy, neurochemistry, neuropharmacology, neurophysiology, and developmental neurobiology. Faculty in the study program are engaged in research that ranges from the molecular to the systems level. The program emphasizes a basic research experience or tutorial under the guidance of a preceptor, a monthly seminar with visiting neuroscientists, and the opportunity to audit appropriate neurobiology courses during the year. Students are encouraged to read widely in areas of basic science under the tutelage of their preceptor.

- *Research Experience.* The basic component of the NVS Study Program is an in-depth research experience in a basic science laboratory under the supervision of one of the participating faculty. There are three levels of involvement in the research process:

Level 1: This is for students who wish to have a full-time experience in the laboratory pursuing an independent research project including an analysis of experiments and communication of the results. Students in this category who wish to attend courses are advised to audit them.

Level 2: This is for students who wish to work in a laboratory to gain familiarity with experimental techniques and the process of doing research. The student is expected to contribute to an ongoing project in the laboratory. Students in this category are encouraged to register for credit for courses in the Department of Neurobiology and other departments.

Level 3: This is for students who do not wish to do laboratory work, but who wish additional training in neuroscience. The students select a mentor, write a review article in a specific area, and take courses in the Department of Neurobiology and other departments.

- *Initial and Final Reports.* Important components of the program are the initial and final reports prepared by the student with the help of his or her preceptor. The initial report is a written statement of the student's goals for the year with a detailed plan for accomplishing these goals. Usually this takes the form of stating the problem to be studied, the hypothesis, and an outline of the work to be done. The final report usually takes the form of a research paper or literature review suitable for publication. Publication is not required, but many students have been successful in publishing a report with their preceptors.

- *Seminar.* Students enrolled in the program meet twice monthly with the program directors for an informal seminar. In the beginning of the fall term, seminars focus on the planned projects of each student. Throughout the year, scientists working in neurobiology and visual sciences from Duke, the University of North Carolina, and the Research Triangle are invited to review their research work with the students. Relevant publications from the laboratories are distributed before the seminar and students are expected to actively participate in discussion. At the end of the spring semester, the seminar focuses on work accomplished as each student presents a short report of her or his research.

FACULTY: Mohamed B. Abou-Donia, Ph.D.; Robert R. H. Anholt, Ph.D.; George J. Augustine, Ph.D.; Jorge V. Bartolome, Ph.D.; Nell Beatty Cant, Ph.D.; John H. Casseday, Ph.D.; Joseph M. Corless, M.D., Ph.D.; Barbara J. Crain, M.D., Ph.D.; Irving T. Diamond, Ph.D.; Gillian Einstein, Ph.D.; Robert P. Erickson, Ph.D.; David Fitzpatrick, Ph.D.; William C. Hall, Ph.D.; Diane L. Hatchell, Ph.D.; Lawrence C. Katz, Ph.D.; Julie C. Kauer, Ph.D.; Gordon Klintworth, M.D., Ph.D.; Cynthia M. Kuhn, Ph.D.; Anthony S. LaMantia, Ph.D.; Darrell V. Lewis, M.D.; William D. Matthew, Ph.D.; David R. McClay, Ph.D.; James O. McNamara, M.D.; John W. Moore, Ph.D.; J. Victor Nadler, Ph.D.; Alan D. Proia, M.D., Ph.D.; Dale Purves, M.D.; Allen D. Roses, M.D.; Saul M. Schanberg, M.D., Ph.D.; Donald E. Schmechel, M.D.; Rochelle D. Schwartz, Ph.D.; Sidney A. Simon, Ph.D.; J. H. Pate Skene, Ph.D.; Theodore A. Slotkin, Ph.D.; George G. Somjen, M.D.;

John Staddon, Ph.D.; Warren J. Strittmatter, M.D.; Dennis A. Turner, Ph.D.; E. Lee Tyrey, Ph.D.; Wilkie A. Wilson, Ph.D.; Myron L. Wolbarsht, Ph.D.; Fulton Wong, Ph.D.

PATHOLOGY STUDY PROGRAM (PSP-301B)

PROGRAM DIRECTORS: Dr. William D. Bradford (*Coordinating Director*), Dr. Keith A. Reimer and Dr. Barbara J. Crain

Pathology is the study of disease through the utilization of structural and functional changes to gain information about the human organism's response to injury. The goal of the Pathology Study Program is to provide the medical student with a thorough learning experience in the anatomical basis of disease under the guidance of a senior faculty preceptor. The essential elements of this program are: (a) organized course work; (b) independent, but guided research experience (bench or library); and (c) active participation in small group seminars.

To meet the diverse interests and needs of Duke medical students, there are three tracks within the Pathology Study Program. All curriculum plans must be approved and signed by Dr. Bradford prior to registration.

PSP Track I

Required Courses:	Systemic pathology; didactic lectures (PTH 241B); student seminars
Elective Courses:	None
Independent Study:	Research with project report
Advisor:	Dr. Keith A. Reimer (684-3659)
Max number students:	10

PSP Track II

Required Courses:	Systemic pathology; didactic lectures (PTH 241B); autopsy, surgical, or cytopathology rotation (PTH 223B, PTH 348B, PTH 281B); student seminars
Elective Courses:	Limited
Independent Study:	Bench or library project
Advisor:	Dr. Barbara J. Crain (684-2229)
Max number students:	10

PSP Track III

Required Courses:	Systemic pathology; didactic lectures (PTH 241B); student seminars; autopsy, surgical or cytopathology rotation (PTH 223B, PTH 348B, PTH 281B)
Elective Courses:	A carefully planned selection of courses in a single area, e.g., molecular pathology, cardiovascular, neuropathology, etc., selected with the advice of a preceptor
Independent Study:	Tutorial library project to supplement course work
Advisor:	Dr. William Bradford (684-5112)
Max number students:	2 (By special arrangement)

Advisory Plan for Pathology Study Program

The Department of Pathology participates in the Medical School orientation to the third year. Following the general information session, interested students may meet with advisors to establish interviews for individual mentors. Every student must have a study program advisor and an individual mentor. The curriculum plan, academic schedule, and registration cards of each student selected for the Pathology Study Program must be reviewed and approved by Dr. Bradford prior to registration.

FACULTY: Dolph O. Adams, M.D., Ph.D.; Darel D. Bigner, M.D., Ph.D.; Sandra H. Bigner, M.D.; Michael J. Borowitz, M.D., Ph.D.; Edward H. Bossen, M.D.; William D. Bradford, M.D.; Stephen J. Bredehoeft, M.D.; Peter C. Burger, M.D.; Dennis A. Clements, M.D., Ph.D.; Barbara J. Crain, M.D., Ph.D.; James D. Crapo, M.D.; Stephen M. Denning, M.D.; Mark W. Dewhirst, D.V.M., Ph.D.; William A. Dittman, M.D.; John A. Feagin, Jr., M.D.; Thomas W. Gettys, Ph.D.; Marcia R. Gottfried, M.D.; Charles S. Greenberg, M.D.; Maureen R. Hoffman, M.D., Ph.D.; David Howell, M.D., Ph.D.; Raymond E. Ideker, M.D., Ph.D.; Peter D. Issitt, Ph.D.; Robert B. Jennings, M.D.; Randy L. Jirtle, Ph.D.; William W. Johnston, M.D.; Hideko Kamino, M.D.; William H. Kane, M.D., Ph.D.; Gordon Klintworth, M.D., Ph.D.; John A. Koepke, M.D.; Roger J. Kurlander, M.D.; Lester Layfield, M.D.; Richard M. Levenson, M.D.; James E. Lowe, M.D.; Herbert K. Lyster, M.D.; Neil R. MacIntyre, M.D.; Kenneth S. McCarty, Jr., M.D., Ph.D.; Sara E. Miller,

Ph.D.; Salvatore V. Pizzo, M.D., Ph.D.; Alan D. Proia, M.D., Ph.D.; Howard Ratech, M.D.; Keith A. Reimer, M.D., Ph.D.; L. Barth Reller, M.D.; Victor L. Roggli, M.D.; Wendell F. Rosse, M.D.; Alfred P. Sanfilippo, M.D., Ph.D.; Frank Sedor, Ph.D.; John D. Shelburne, M.D., Ph.D.; Joachim R. Sommer, M.D.; Charles Steenbergen, M.D., Ph.D.; John G. Toffaletti, Ph.D.; Robin T. Vollmer, M.D.; Philip J. Walther, M.D., Ph.D.; Brice Weinberg, M.D.; Frances K. Widmann, M.D.; Peter Zwadyk Jr., Ph.D.



ROSTER OF HOUSE STAFF BY DEPARTMENTS

Anesthesiology

Chief Residents 1992-1993: Lewis H. Hogge, Jr., M.D. (Eastern Virginia, 1986); Todd LeBleu, M.D. (Emory, 1989).

Senior Residents: Francine D'Ercole, M.D. (Med. Coll. of Pennsylvania, 1989); Mark Dentz, M.D. (Michigan, 1989); Charlene Edwards, M.D. (Maryland, 1989); Denise Elliott, M.D. (Arkansas, 1989); Brian Flanagan, M.D. (Duke, 1989); Randall Franiak, M.D. (Indiana, 1989); Salim Ghazi, M.D. (St. Joseph University, Lebanon, 1986); C. Thomas Moran, M.D. (South Carolina, 1986); R. J. Moskop, M.D., (Tennessee, 1989); John P. Murphy, M.D. (Bowman Gray, 1982); W. Frederick Obrecht, M.D. (Maryland, 1979); Keith Phillippi, M.D. (Med. Coll. of Georgia, 1989); Rosemarie Spillane, M.D. (Med. Coll. of Georgia, 1989); Frank Wang, M.D. (Florida, 1989); Dana Wiener, M.D. (Duke, 1989).

Junior Residents: Nicholas Audeh, M.D. (Robert Wood Johnson, 1990); David Bacon, M.D. (Duke, 1990); Elliott Bennett-Guerrero, M.D. (Harvard, 1991); Jon Bignault, M.D. (Med. Coll. of Georgia, 1990); Donna Boyd, M.D. (California at San Diego, 1991); James A. Calabrese, M.D. (New York at Stony Brook, 1991); John Castellano, M.D. (Eastern Virginia, 1985); James Chimiak, M.D. (North Carolina at Chapel Hill, 1986); David A. Demangone, M.D. (Pittsburgh, 1991); Philip Dulberger, M.D. (Indiana, 1990); Daniel P. Gianturco, M.D. (North Carolina at Chapel Hill, 1991); Josef P. Grabmayer, M.D. (New York at Brooklyn, 1991); Francisco Grinberg, M.D. (National Autonomous University of Mexico, 1978); Michael S. Howard, M.D. (Emory, 1991); Scott T. Howell, M.D. (Duke, 1986); Clarence Huggins, M.D. (South Carolina, 1990); Warriner Inge, M.D. (Duke, 1990); William T. H. Jones, M.D. (South Carolina, 1991); Laurie Jordan, M.D. (North Carolina at Chapel Hill, 1991); Stephen Katz, M.D. (Louisiana State, 1990); George King, M.D. (Wisconsin, 1989); Nancy W. Knudsen, M.D. (Missouri, 1991); Samir M. Koussa, M.D. (American University of Beirut, 1989); Paige Latham, M.D. (Texas A & M, 1990); Mark Lazar, M.D. (Pittsburgh, 1990); David C. Nauss, M.D. (Temple, 1991); Robin H. Patty, M.D. (Duke, 1991); Vincent Phillips, M.D. (North Carolina at Chapel Hill, 1991); Mark Raccasi, M.D. (Texas at Houston, 1991); Nathan Rachman, M.D. (South Florida, 1990); Michael D. Sebastian, M.D. (Louisiana State, 1987); Jonathan Snyder, M.D. (Albany, 1990); Pamela Thomas-King, M.D. (Wisconsin, 1989); Verna Yancy, M.D. (California at Los Angeles, 1991); Yeu Wang, M.D. (Chicago, 1990); Vida Yasmin, M.D. (Eugenio Maria De Hostos School of Medicine, Dominican Republic, 1985).

Community and Family Medicine

Chief Residents: Evarista C. Nnadi, M.D. (Mayo, 1990); Yasmin A. Orandi, M.D. (Rush, 1990).

Residents: David P. Adams, M.D. (North Carolina at Chapel Hill, 1992); Vanessa M. Allen, M.D. (Howard, 1989); Brian J. Benjamin, M.D. (Rochester, 1991); Mignon F. Benjamin, M.D. (Rochester, 1991); Helen Benveniste, M.D. (Denmark, 1986); J. Wallace Davies, M.D. (Jefferson, 1991); Mary E. Faini, M.D. (Georgetown, 1986); Michael J. Hovan, M.D. (Colorado, 1990); Georgiana Huang, M.D. (Utah, 1971); Ronald W. Jarl, M.D. (New Jersey, 1991); William K. Joyner, M.D. (Jefferson, 1992); Anne R. Johnson, M.D. (North Carolina at Chapel Hill, 1991); David S. Johnson, M.D. (Minnesota, 1990); David I. Klumpar, M.D. (Columbia, 1985); David D. Lewis, M.D. (Virginia, 1991); David M. Quillen, M.D. (North Carolina at Chapel Hill, 1992); Frederick S. Risener, M.D. (South Carolina, 1990); Gertrude K. Shahady, M.D. (North Carolina at Chapel Hill, 1989); Scott M. Sheflin, M.D. (Hahnemann, 1990); Amrit R. Singh, M.D. (West Virginia, 1990); Almaz A. Smith, M.D. (Texas at San Antonio, 1992); Brigitta T. Stengele, M.D. (Germany, 1989); Elizabeth R. Strabel, M.D. (Louisiana, 1991); Anjali M. Sues, M.D. (North Carolina at Chapel Hill, 1992); Denise D. Tollefson, M.D. (Kansas, 1991); Sorahi Toloyan, M.D. (Iran, 1974); Donna M. Tuccero, M.D. (Wayne State, 1989); Asha Vali, M.D. (India, 1978); Beth A. Wallen, M.D. (Johns Hopkins, 1991).

Medicine

Chief Residents: William R. Hathaway, M.D. (Med. Coll. of Wisconsin, 1988); K. Michael Zakel, M.D. (Washington Univ., 1988).

Senior Assistant Residents: John M. Arthur, M.D. (Iowa, 1990); Rebecca E. Barrington, M.D. (Texas A & M, 1990); Elizabeth A. Bearer, M.D. (Miami, 1990); Kurt O. Bodily, M.D. (Washington, 1990); Christina M. Brown, M.D. (Syracuse, 1990); Todd L. Burstain, M.D. (Texas, Southwestern, 1990); Russ P. Carstens, M.D. (Yale, 1990); Brian S. Crenshaw, M.D. (Tennessee, 1990); Jennie R. Crews, M.D. (Duke, 1990); William A. Flood, M.D. (Temple, 1990); Carl E. Gessner, M.D. (Maryland, 1990); Niti Goel, M.D. (Jefferson, 1990); Tamar B. Green, M.D. (Duke, 1990); James F. Hochrein, M.D. (Ohio, 1990); Mark D. Kelemen, M.D. (Johns Hopkins, 1990); John M. Kilby, M.D. (North Carolina at Chapel Hill, 1990); Karin S. Linthicum, M.D. (Georgetown, 1990); Donna D. Loundes, M.D. (McGill, 1990); Kevin S. McAllister, M.D. (Rush, 1990); David W. Miller, M.D. (Med. Coll. of Georgia, 1990); Mark F. Miller, M.D. (Duke, 1990); Craig R. Narins, M.D. (New York at Buffalo, 1990); Reid M. Ness, M.D. (Indiana, 1990); Michael I. Oliverio, M.D. (West Virginia, 1990); Laura A. Peno-Green, M.D. (South Alabama, 1990); Joann Pfundstein, M.D. (Robert Wood Johnson, 1990); Michael F. Reidy, M.D. (George Washington, 1990); Thomas W. Rennard, M.D. (Michigan, 1990); Clara I. Restrepo, M.D. (Louisiana, 1990); Richard M. Roman, M.D. (Tufts, 1990); Renato M. Santos, M.D. (Iowa, 1990); Mark W. Swaim, M.D. (Duke, 1990); Nathan M. Thielman, M.D. (Duke, 1990); Kathleen

A. Waite, M.D. (Duke, 1990); Craig R. Weinert, M.D. (George Washington, 1990); Jeffrey W. Weinstein, M.D. (Tufts, 1989); Roger D. Yusen, M.D. (Illinois, 1990).

Medicine/Pediatrics: Mark S. McIntosh, M.D. (Duke, 1989); James W. Short, M.D. (Texas at Houston, 1989).

Junior Assistant Residents: Murray A. Abramson, M.D. (Duke, 1991); Mandip K. Ajit-Appal, M.D. (India, 1991); Gregory W. Barsness, M.D. (Minnesota, 1991); Hina W. Chaudhry, M.D. (Harvard, 1991); Richard L. Crownover, M.D. (Duke, 1991); Michael S. Cuffe, M.D. (Duke, 1991); Rowena J. Dolor, M.D. (Duke, 1991); Jason A. Dominitz, M.D. (Maryland, 1991); David M. Frucht, M.D. (Duke, 1991); William R. Harlan, M.D. (Duke, 1991); Lynda Anne S. Hodgson, M.D. (Jefferson, 1991); Nicole E. Jelesoff, M.D. (Georgetown, 1991); Sheri A. Keitz, M.D. (Sinai, 1991); Mirna F. Ktali, M.D. (Beirut, 1991); Scott G. Lilly, M.D. (Med. Coll. of Ohio, 1991); Lisa A. Maier, M.D. (Duke, 1991); Edward I. Morris, M.D. (Howard, 1991); Crystal A. Mullen, M.D. (Johns Hopkins, 1991); James C. Oates, M.D. (Johns Hopkins, 1991); Lorianne Pallai, M.D. (Tulane, 1991); Derek A. Persons, M.D. (Duke, 1991); Ramin Rabbani, M.D. (Michigan, 1991); Adrienne Richards, M.D. (Johns Hopkins, 1991); Ernst-Gilbert Schreiber, M.D. (Cologne, 1987); Eric A. Sheldon, M.D. (Tulane, 1991); Michael A. Shetzline, M.D. (Ohio State, 1991); Marjorie K. Soper, M.D. (Virginia, 1991); Michael E. Staab, M.D. (Colorado, 1991); James C. Strobel, M.D. (Indiana, 1991); John S. Sundry, M.D. (Hahnemann, 1991); Shie-Pon Tzung, M.D. (Taiwan, 1986); Bryan D. Uslick, M.D. (Ohio State, 1991); Marcel R. Van den Brink, M.D. (Leiden, 1985); Marc A. Warmuth, M.D. (Texas at Houston, 1991); David A. Wohl, M.D. (Robert Wood Johnson, 1991).

Medicine/Pediatrics: Vandana Y. Bhide, M.D. (Wisconsin, 1991); Melissa C. Corcoran, M.D. (Duke, 1990); Tamera D. Coyne, M.D. (Duke, 1991); Karl M. Duerr, M.D. (University of Munich, 1988); Katherine G. Mulligan, M.D. (New Jersey, 1991); Roberts H. Smith, M.D. (Texas at Houston, 1990); Joseph J. Van Nort, M.D. (Pennsylvania State, 1990); Susan M. Wang, M.D. (Columbia, 1991).

Interns: Mark F. Aaron, M.D. (Duke, 1992); Alan S. Ament, M.D. (Chicago, 1992); Marissa F. Baldassano, M.D. (Pennsylvania State, 1992); Bshara J. Barakat, M.D. (Beirut, 1992); Marcel D. Bingham, M.D. (North Carolina at Chapel Hill, 1992); Ernest P. Bouras, M.D. (Duke, 1992); S. Maynard Bronstein, M.D. (Duke, 1992); Kenneth M. Burnham, M.D. (Emory, 1992); Patrick J. Cawuley, M.D. (Georgetown, 1992); Pamela L. Charity, M.D. (Hahnemann, 1992); Gabriella F. Dennery, M.D. (Howard, 1992); Sanjay A. Desai, M.D. (Washington Univ., 1992); Robert L. Deucher, M.D. (Duke, 1992); Pang-Chieh "Jerry" Eu, M.D. (Chicago, 1992); Mary J. Geiger, M.D. (Med. Coll. of Wisconsin, 1992); Thomas A. Grady, M.D. (Tufts, 1992); David H. Graff, M.D. (Duke, 1992); Richard K. Groger, M.D. (Case Western Reserve, 1992); Elana Gutman, M.D. (St. Louis, 1992); Eugenio J. Hernandez, M.D. (Duke, 1992); Stephen S. Hwang, M.D. (China Med. Coll., 1987); Fern M. Jeffries, M.D. (Johns Hopkins, 1992); Khuda-Dad Khan, M.D. (Nishtar Med. Coll., 1984); Ali M. Kizilbash, M.D. (Aga Khan Univ., 1990); Michael A. Kjelsberg, M.D. (Johns Hopkins, 1992); Paul A. Lawrence, M.D. (South Carolina, 1992); Ruey-Min "Ray" Lee, M.D. (National Taiwan Univ., 1986); Kirsten E. Lyke, M.D. (Georgetown, 1992); Kevin M. McGrath, M.D. (Jefferson, 1992); Klaus Mergener, M.D. (Heidelberg, 1989); Julie M. Miller, M.D. (Minnesota, 1992); Robert E. Minahan, M.D. (Duke, 1992); Sandra Y. Morelock, M.D. (Tennessee, 1992); Lia S. Murphy, M.D. (Johns Hopkins, 1992); H. Derek Palmer, M.D. (Washington, 1992); Robert S. Penczak, M.D. (Med. Coll. of Pennsylvania, 1992); Robert C. Quackenbush, M.D. (Washington Univ., 1992); Spencer H. Shao, M.D. (Duke, 1992); Ted S. Steiner, M.D. (Duke, 1992); Mark S. Sulkowski, M.D. (Temple, 1992); Julio Tallet, M.D. (Chicago, 1992); Chirayu Udomsakdi (Siriraj Sch. of Med., 1988); Stephen J. Wilson, M.D. (Duke, 1992).

Medicine/Pediatrics: Cory L. Annis, M.D. (Med. Coll. of Georgia, 1992); Elaine A. Bradshaw, M.D. (Stanford, 1992); William J. Dwyer, M.D. (Yale, 1992); Herodotos Ellinas, M.D. (Chicago, 1992); Jeffrey H. Moreadith, M.D. (Duke, 1992).

Fellows: Igor Z. Abolnik, M.D. (Hadassah Med. Sch., 1988); Raquelle D. Alexander, M.D. (Miami, 1989); Lee F. Allen, M.D. (New Jersey, 1987); P. Ian Andrews, M.D. (Univ. of New South Wales, 1978); Lennox K. Archibald, M.D. (Univ. Coll. Med. Sch. London, 1984); Brian A. Armstrong, M.D. (Washington Univ., 1988); Todd H. Baron, M.D. (Florida, 1986); Michael P. Bates, M.D. (Pennsylvania, 1988); Maher A. Baz, M.D. (Beirut, 1989); Michael A. Blazing, M.D. (California at San Francisco, 1987); Arline D. Bohannon, M.D. (New York at Syracuse, 1988); Damian A. Brezinski, M.D. (Johns Hopkins, 1989); Brigitta C. Brott, M.D. (Loyola, 1988); Ann J. Brown, M.D. (Stanford, 1988); John S. Bruch, M.D. (Virginia, 1985); Matthew P. Bunyard, M.D. (Med. Coll. of Ohio, 1987); Richard L. Callihan, M.D. (Marshall, 1989); Imhotep K. A. Carter, M.D. (Illinois, 1989); Kevin J. Casey, M.D. (Case Western Reserve, 1987); Donato Ciacia, M.D. (Wisconsin, 1989); Walter K. Clair, M.D. (Harvard, 1981); Stephen D. Coleman, M.D. (California at San Francisco, 1987); Peter J. Conlon, M.D. (Royal Coll. of Surgeons, 1986); Randolph A. S. Cooper, M.D. (Duke, 1987); Tina D. Covington, M.D. (Howard, 1987); Katie C. Cowan, M.D. (Texas at San Antonio, 1988); Gary M. Cox, M.D. (Virginia, 1989); Andrew M. Cross, M.D. (New York at Brooklyn, 1987); J. Allen Crow, M.D. (Vanderbilt, 1987); Wendy Z. Davis, M.D. (Duke, 1989); David DeNofrio, M.D. (Tufts, 1988); G. Alfred Dodds, M.D. (Med. Coll. of Ohio, 1988); Glenn M. Eisen, M.D. (Albert Einstein, 1987); Maha A. Elkordy, M.D. (North Carolina at Chapel Hill, 1988); Osemwegie E. Emovon, M.D. (Benin, 1985); Robert E. Federici, M.D. (Georgetown, 1988); David C. Fisher, M.D. (Massachusetts, 1989); Rodney J. Folz, M.D. (Washington Univ., 1989); Terry L. Forrest, M.D. (Indiana, 1986); Jonathan C. Fox, M.D. (Chicago, 1987); Neil J. Freedman, M.D. (Harvard, 1985); Richard Frothingham, M.D. (Duke, 1981); Susan C. Galbraith, M.D. (Ohio State, 1988); Marc Gautier, M.D. (Dartmouth, 1986); Angela Gentili, M.D. (Pavia Univ., 1986); Brian J. Gilmore, M.D. (Pennsylvania, 1988); Helen L. Goldberg, M.D. (Med. Coll. of Pennsylvania, 1988); Clifton L. Gooch, M.D. (Baylor, 1988); Taylor R. Graves, M.D. (Johns Hopkins, 1989);

Stuart A. Green, M.D. (Tennessee, 1988); Carol L. Gruver, M.D. (Temple, 1984); Christine G. Hahn, M.D. (Michigan State, 1988); Mark E. Hamer, M.D. (Northwestern, 1986); David K. Handshoe, M.D. (Mississippi, 1984); Robert A. Harrington, M.D. (Tufts, 1986); James E. Hartle, M.D. (Albert Einstein, 1985); Steven E. Hearne, M.D. (Maryland, 1989); James B. Hermiller, M.D. (Ohio, 1983); William B. Hillegass, M.D. (Harvard, 1988); Russell E. Hillsley, M.D. (Washington Univ., 1988); Bernadette Hughes, M.D. (Georgetown, 1988); Francisco J. Jimenez-Acosta, M.D. (Navarra, 1983); Eric D. Johnson, M.D. (Northeastern Ohio, 1986); Souha S. Kanj, M.D. (St. Joseph, 1987); Andrew C. H. Kao, M.D. (Chicago, 1988); Kathryn B. Kirkland, M.D. (Dartmouth, 1986); Jeffrey M. Kopita, M.D. (Med. Coll. of Ohio, 1989); Eugene C. Kovalik, M.D. (McGill, 1987); Kevin R. Kruse, M.D. (Ohio, 1989); Marino Labinaz, M.D. (Queens Univ., 1987); J. Eugene Lammers, M.D. (South Alabama, 1982); Carol A. Langford, M.D. (California at Los Angeles, 1987); Mary J. Laughlin, M.D. (New York at Buffalo, 1988); Eunkyoo Lee, M.D. (Maryland, 1986); John G. Lee, M.D. (Miami, 1987); Michael E. Lee, M.D. (North Carolina at Chapel Hill, 1988); Namsoo Lee, M.D. (Seoul, 1983); Eric D. Libby, M.D. (Harvard, 1987); Eric B. Lieberman, M.D. (Emory, 1987); Kevin Lorentsen, M.D. (Johns Hopkins, 1989); Louis M. Luttrell, M.D. (Virginia, 1989); Gustav C. Magrinat, M.D. (North Carolina at Chapel Hill, 1987); Donna K. Maneice, M.D. (Cincinnati, 1987); Allen W. Mangel, M.D. (Georgetown, 1988); P. Kelly Marcom, M.D. (Baylor, 1989); Gary R. May, M.D. (Alberta, 1985); Bruce N. Mayes, M.D. (Vanderbilt, 1988); J. Jay Merrill, M.D. (Washington, 1986); Diane M. Metzler, M.D. (Minnesota, 1987); William C. Miller, M.D. (Johns Hopkins, 1985); Raja Mudad, M.D. (Beirut, 1989); Lawrence A. Nair, M.D. (Pennsylvania, 1988); Paul E. Nathan, M.D. (St. George's, 1987); L. Kristin Newby, M.D. (Indiana, 1987); Michael K. Newcomer, M.D. (Case Western Reserve, 1988); Thuy T. Ngo, M.D. (Minnesota, 1988); Carleton T. Nibley, M.D. (California at Los Angeles, 1988); Jane E. Onken, M.D. (George Washington, 1987); Ajay J. Pathak, M.D. (M. P. Shah, 1982); Suzanne Patton, M.D. (Duke, 1988); Paul A. Payne, M.D. (Duke, 1987); John N. Perry, M.D. (Pittsburgh, 1988); Eric D. Peterson, M.D. (Pittsburgh, 1988); Robert J. Pritchard, M.D. (Wayne State, 1989); Ali R. Rahimi, M.D. (Ferdowsi, 1974); Jayalakshmi Rao, M.D. (Florida, 1987); Vera H. Rigolin, M.D. (Northwestern, 1988); Reed D. Riley, M.D. (Johns Hopkins, 1988); Payl A. Robiolio, M.D. (Washington Univ., 1989); Sharona Sachs, M.D. (New York at Buffalo, 1988); W. Eugene Sanders, M.D. (North Carolina at Chapel Hill, 1985); Aneysa C. Sane, M.D. (Duke, 1987); Colleen M. Schmitt, M.D. (South Alabama, 1986); Stephen M. Schutz, M.D. (Albany, 1988); James K. Schwarz, M.D. (Duke, 1987); Paul J. Shami, M.D. (Beirut, 1988); Ala I. Sharara, M.D. (Beirut, 1987); Mary D. Shearin, M.D. (North Carolina at Chapel Hill, 1989); Hossein Shenasa, M.D. (Behshti, 1984); Gary B. Sherrill, M.D. (North Carolina at Chapel Hill, 1989); Orlando Silva, M.D. (Northwestern, 1988); Steven G. Simonson, M.D. (Med. Coll. Wisconsin, 1986); Sharon A. Smith, M.D. (Southwestern, 1989); Kathleen Stewart, M.D. (Virginia, 1989); Linda M. Sutton, M.D. (Massachusetts, 1987); Paul R. Tarnasky, M.D. (Washington, 1989); David E. Taylor, M.D. (Vanderbilt, 1987); Mark C. Thel, M.D. (Georgetown, 1986); Michael J. Thompson, M.D. (Massachusetts, 1986); Frank E. Tice, M.D. (Ohio State, 1986); James F. Trotter, M.D. (Emory, 1989); D. Michael Unks, M.D. (Pittsburgh, 1987); Karen E. Weltywolf, M.D. (Duke, 1986); David W. Shalley, M.D. (Sydney, 1982); Heidi K. White, M.D. (Washington Univ., 1989); John S. Wilson, M.D. (Pennsylvania State, 1986); David W. Winingar, M.D. (Indiana, 1989); Lynn A. Witty, M.D. (Indiana, 1987).

DIVISION OF DERMATOLOGY

Josepha Bueno, M.D. (Pennsylvania, 1988); Susan C. Carson, M.D. (Duke, 1988); Thomas N. Darling, M.D. (Duke, 1990); James M. Grichnik, M.D. (Harvard, 1990); Robin L. Hornung, M.D. (Yale, 1990); Catherine M. Hren, M.D. (Duke, 1991); Sarah C. Myers, M.D. (Duke, 1989); Michael R. Roborn, M.D. (Toronto, 1986); Kathryn Schwarzenberger, M.D. (Texas, 1987); Nhu-Linh T. Tran, M.D. (Duke, 1991).

DIVISION OF NEUROLOGY

James B. Caress, M.D. (George Washington, 1990); Nathaniel Carter, M.D. (Iowa, 1990); Mark C. Cascione, M.D. (Vermont, 1991); Thomas T. Devlin, M.D. (Baylor, 1991); Marian L. Evatt, M.D. (Emory, 1989); James F. Hora, M.D. (Loyola, 1990); Vern C. Juel, M.D. (Illinois, 1989); Heidi A. Loganbill, M.D. (Dartmouth, 1991); Kimberly A. Mebust, M.D. (Connecticut, 1990); William E. Ondo, M.D. (Med. Coll. of Virginia, 1991); Burton L. Scott, M.D. (Miami, 1990); Mark B. Skeen, M.D. (Miami, 1982); Leanne K. Willis, M.D. (Texas at Houston, 1989).

Obstetrics and Gynecology

Chief Residents: Sanjay Agarwal, M.D. (Univ. of London, 1986); Tracy Collins, M.D. (Temple, 1989); Pamela Johnson, M.D. (Illinois, 1989); Sarah Keller, M.D. (Southern Illinois, 1989); John H. Moore, M.D. (Tulane, 1989); Karen D. Roane, M.D. (East Carolina, 1987); James Roth, M.D. (Utah, 1989); Stephen Somkuti, M.D. (North Carolina at Chapel Hill, 1989).

Assistant Residents: Christine Battin, M.D. (Pittsburgh, 1992); Allison Blomer, M.D. (Colorado, 1990); Michael Carney, M.D. (Loyola, 1990); Pamela Carney, M.D. (Loyola, 1990); Peter Dargie, M.D., Ph.D. (Minnesota, 1991); Martha Ehrmann, M.D. (Duke, 1991); Anthony Evans, M.D., Ph.D. (Med. Coll. of Georgia, 1990); Rebecca Fillia, M.D. (Wisconsin, 1990); Elizabeth Gorman, M.D. (Georgetown, 1992); Andre Hall, M.D. (Cincinnati, 1992); Hytham Imseis, M.D. (Louisiana, 1991); Robert Lalouche, M.D. (California, 1991); J. Rebecca Liu, M.D. (Vanderbilt, 1991); Craig McClelland, M.D. (Virginia, 1992); Celia Mendes, M.D. (Brown, 1991); Paul Miller, M.D.

(Columbia, 1990); Amy Murtha, M.D. (Med. Coll. of Pennsylvania, 1992); Jonathan Paley, M.D. (Rochester, 1991); Karen Perkins, M.D. (Tufts, 1991); Kerry Rodabaugh, M.D. (Duke, 1990); Winifred Soufi, M.D., Ph.D. (Illinois, 1992).

Ophthalmology

Chief Resident: Alexander Eaton, M.D. (Duke, 1987).

Residents: Bawa Dass, M.D. (Michigan, 1990); Kattayoon Hashemi, M.D. (Georgetown, 1990); Joseph Khawly, M.D. (Duke, 1991); Pauline Merrill, M.D. (Washington Univ., 1991); Scott Pendergast, M.D. (Boston, 1991); Karen Popovich, M.D. (North Carolina at Chapel Hill, 1990); Eric Postel, M.D. (Jefferson, 1991); Angela Royster, M.D. (North Carolina at Chapel Hill, 1990); Mark Scroggs, M.D. (Duke, 1984); Jeffrey Singer, M.D. (Virginia, 1990).

Pathology

Residents: Mark R. Atkins, M.D. (Bowman Gray, 1989); Nicholas Bandarenko III, M.D. (Duke, 1990); Marcia A. Barnes, M.D. (Pennsylvania, 1990); Alice Coogan, M.D. (Vanderbilt, 1988); Kenneth S. Ellington, M.D. (Bowman Gray, 1990); David Farris, M.D. (Duke, 1991); Holly Faust, M.D. (Ohio State, 1986); Catherine Fischer, M.D. (North Carolina at Chapel Hill, 1991); Loretta B. Gaido, M.D. (Med. School of Honduras, 1982), Ph.D. (Emory, 1988); Julian Garcia, M.D. (Miami, 1988); Tim Gladden (Indiana, 1992); Laura Pope Hale, M.D. (Duke, 1991), Ph.D. (Duke, 1990); Janice J. Hessling, M.D. (Duke, 1988), Ph.D. (Duke, 1980); Michael Hitchcock, M.D. (Univ. of Auckland, New Zealand, 1982); Stacey N. Ibrahim, M.D. (North Carolina at Chapel Hill, 1989); Kenneth Kassenbrock, Ph.D. (California at San Francisco, 1988), M.D. (California at San Francisco, 1989); Kathryn L. Lane, M.D. (Missouri, 1989); Ruth Anne Lininger, M.D. (North Carolina at Chapel Hill, 1990); Jeanne Marie V. Lo, M.D. (Tulane, 1990); John F. Madden, M.D., Ph.D. (Duke, 1988); William Mangano, M.D. (North Carolina at Chapel Hill, 1992); D. Marcheschi, M.D. (Med. Coll. of Ohio, 1992); Susan L. Mastovich, M.D. (Colorado, 1989); Deirdre McDonagh, M.D. (Duke, 1991); Josh McDonald M.D. (Duke, 1990); Elizabeth Jayne Moffatt, M.D. (East Tennessee, 1990); Thomas J. Montine, M.D. (McGill Univ., 1991), Ph.D. (Rochester, 1988); Gary Procop, M.D. (Marshall, 1992); Nathan Pulkingham, M.D. (East Carolina, 1988); Ann Marie Souchick, M.D. (Med. Coll. of Wisconsin, 1990); Timothy Stenzel, Ph.D. (Duke, 1991), M.D. (Duke, 1992); Ricky Alan Thompson, M.D. (East Tennessee, 1990); J. Toso, M.D. (Pittsburgh, 1992); Richard Vander Heide, M.D. (Northwestern, 1989), Ph.D. (Northwestern, 1986); Tim D. Wax, M.D. (Mississippi, 1989); James Andrew Winter, M.D. (Ohio State, 1991); Robert L. Zimmerman, M.D. (Pittsburgh, 1991).

Fellows: Osbert Blow, M.D. (Duke, 1987); Marc Perkins, M.D. (Southwestern Texas, 1984); Karen Mann, M.D. (Tufts, 1988), Ph.D. (Tufts, 1986).

Pediatrics

Chief Resident: Ira Cheifetz, M.D. (Yale, 1989).

Third Year Residents: Winston Banez, M.D. (Philippines, 1989); Robert Bart, M.D. (John Burns, 1990); Beatriz Cua, M.D. (East Ramon Magsaysay, Philippines, 1989); Bruce Finkel, M.D. (South Carolina, 1990); Haydar Frangoul, M.D. (American Univ. of Beirut, 1990); Cecilia Kuyper, M.D. (Washington, 1990); Jennifer Lawson, M.D. (Vermont, 1990); Arif Mannan, M.B. (Dow Med. Coll., Pakistan, 1989); Lisa Michaels, M.D. (Virginia, 1990); Steven Novek, M.D. (North Carolina at Chapel Hill, 1989); Lirio Palmos, M.D. (West Visayas State Coll., Philippines, 1979); Kathleen Riley, M.D. (Albany, 1990); Anita Zaidi, M.D. (Aga Khan Med. Coll., 1988).

English Exchange Resident: Sarah Hope, M.B., Ch.B. (Edinburgh, Scotland, 1989).

Second Year Residents: Krista Amendola, M.D. (New York, 1991); Susanne Bagas, M.D. (Dartmouth, 1991); Kevin Baskin, M.D. (Creighton, 1991); Melissa Clepper-Faith, M.D. (South Florida, 1990); Steven Ehrreich, M.D. (Maryland 1991); Kenneth Goldschneider, M.D. (Connecticut, 1991); Jack Horowitz, M.D. (Connecticut, 1991); Currie Howard, M.D. (East Carolina, 1991); Mary Jeffries, M.D. (Virginia, 1991); James Rost, M.D. (Brown, 1991); Sharon Smith, M.D. (Bowman Gray, 1991); Misrak Tadesse, M.D. (Texas at San Antonio, 1991); Curt Watkins, M.D. (Tufts, 1991).

First Year Residents: Jacqueline Barday, M.D. (Pittsburgh, 1992); Eleanor Beacham, M.D. (Mercer, 1992); Terrill Bravender, M.D. (Michigan, 1992); Stephen Combs, M.D. (Quillen, 1992); Khaled El-Hoshy, M.B., Ch.B. (Cairo, 1980); Marilyn Idriss, M.D. (Duke, 1992); Dexter Kennedy, M.D. (Stanford, 1992); Alisa Lancaster, M.D. (Duke, 1992); Eunju Metzler, M.D. (Tennessee, 1992); Jenny Pang, M.D. (Johns Hopkins, 1992); Mona Shah, M.D. (South Carolina, 1992); Donna Simmons, M.D. (Temple, 1992); Karen Wood, M.D. (North Carolina at Chapel Hill, 1992).

Fellows: Kenneth Alexander, M.D. (Washington, 1989); Thomas Allred, M.D. (Med. Univ. South Carolina, 1987); Nejemie Alter, M.D. (Univ. Nacional Autonoma de Mexico, 1983); Ulus Atasoy, M.D. (Minnesota, 1984); Donald Black, M.D. (New York, 1989); Miguella Caniza, M.D. (Univ. Nacional de Asuncion, Paraguay); Janet Casey, M.D. (Case Western Reserve, 1987); Robert Colbert, M.D. (Rochester, 1987); John County, M.D. (Case Western Reserve, 1984); Adam Cutler, M.D. (Tel Aviv, 1989); Ghassan Dbaibo, M.D. (American Univ. of Beirut, 1986); Dean Scott Edell, M.D. (AUC Coll. Med., British West Indies, 1987); Dean Firschein, M.D. (Robert Wood Johnson, 1989); Julie Fishbein, M.D. (Maryland, 1985); Charles Hemenway, M.D. (Massachusetts, 1987); Helen Hochreutener, M.D. (Univ. Freiburg and Zurich, Switzerland, 1982); Chacko John, M.B.B.S. (T. D. Med. Coll., India, 1982); Gurdev Judge, M.D. (GGS Med.

Col., Faridkot, India); Esam Kazem, M.D. (Al-Azhar, Egypt, 1981); Frank Keller, M.D. (North Carolina at Chapel Hill, 1986); Priya Kishnani, M.B., B.S. (Bombay, 1985); William Lavietes, M.D. (East Carolina, 1987); Jennifer Li, M.D. (Duke, 1987); J. Blake Long, M.D. (Duke, 1986); Albert Moghrabi, M.D. (Montreal, 1985); Robert Nahouraii, M.D. (Pittsburgh, 1989); David Nash, M.D. (Cincinnati, 1989); Steve Nelson, M.D. (Eastern Virginia, 1987); Virinder Nohria, M.D. (Univ. of Cambridge, U.K., 1985); Eva Nozik, M.D. (Colorado, 1988); Andrew Pendleton, M.D. (South Carolina, 1989); Rosario Riel, M.D. (Philippines, 1986); Emilia Rivadeneira, M.D. (Univ. Nacional de Cordoba, Argentina, 1982); Ziad Saba, M.D. (American Univ. of Beirut, 1987); krystal Sanchez, M.D. (Florida, 1989); Susanne Speier, M.D. (Hamburg, Germany, 1989); Jana Stockwell, M.D. (Texas, Southwestern, 1986); Donald Strickland, M.D. (Missouri, 1988); Charles Trant, M.D. (East Carolina, 1989); Michael Vance, M.D. (Rochester, 1986); Johan Van Hove, M.D. (Katholieke Univ., Belgium, 1986); Masayo Watanabe, M.D. (Kansas, 1986); Stuart Winter, M.D. (Wisconsin, 1988); James Woodward, M.D. (St. Louis, 1989); Hani Zriek, M.S. (St. Joseph Univ., Beirut, 1987).

Medicine/Pediatrics Fourth Year Residents: Mark McIntosh, M.D. (Duke, 1989); James Short, M.D. (Texas at Houston, 1989).

Third Year Residents: Melissa Corcoran, M.D. (Duke, 1990); Michael Duerr, M.D. (West Germany, 1988); Roberts Smith, M.D. (Texas at Houston, 1990); Joseph VanNort, M.D. (Pennsylvania State, 1990).

Second Year Residents: Vandana Rhide, M.D. (Wisconsin, 1991); Tamera Coyne, M.D. (Duke, 1991); Katherine Mulligan, M.D. (New Jersey, 1991); Susan Wang, M.D., M.P.H. (Columbia, 1991).

First Year Residents: Cory Annis, M.D. (Med. Coll. of Georgia, 1992); Elaine Bradshaw, M.D. (Stanford, 1992); William Dwyer, M.D. (Yale, 1992); Herodotos Ellinas, M.D. (Chicago, 1992); Jeffrey Moreadith, M.D. (Duke, 1992).

Psychiatry

Chief Residents: John L. Beyer, M.D. (Texas, Southwestern, 1989); Thomas M. Brown, M.D. (Duke, 1989); Leland Dennis, M.D. (Oklahoma, 1989); Craig L. Donnelly, M.D. (Vermont, 1989); Rodrigo Escalona, M.D. (Univ. of Chile, 1987); Howard J. Ilivicky, M.D. (Washington, 1989); Mark F. McGee, M.D. (Ohio State, 1989); Susan Wicke, M.D. (Ohio, 1989).

Fourth Year Residents: Peter N. Barboriak, M.D. (Duke, 1989); Michael A. Burke, M.D. (Georgia, 1989); Peter T. Daniolos, M.D. (North Dakota, 1989); Martin Kneece, M.D. (Vanderbilt, 1985); Paul W. Natvig, M.D. (Iowa, 1989); Gary B. Pohl, M.D. (Michigan State, 1989).

Third Year Residents: Eileen Ahearn, M.D. (Duke, 1990); John Bennett, M.D. (Southwestern, 1990); Pablo Davanzo, M.D. (Chile, 1987); Kara Forest, M.D. (Southwestern, 1990); Barbara Johnson, M.D. (Minnesota, 1990); Debora LaMonica, M.D. (Massachusetts, 1989); Joseph Lucas, M.D. (Alabama, 1990); James Michalets, M.D. (Wisconsin 1990); Cherri Miner, M.D. (Michigan, 1990); Holly Rogers, M.D. (Southwestern, 1990); Mary Soderstrom, M.D. (Southwestern, 1990); Katherine White-Vaughn, M.D. (Mayo, 1990).

Second Year Residents: Tedra Anderson-Brown, M.D. (Duke, 1991); Sarah Book, M.D. (Duke, 1991); Bruce Capehart, M.D. (Southwestern at Dallas, 1991); Richard D'Alli, M.D. (Arizona, 1991); Murali Doraiswamy, M.D. (Madras, India, 1986); Madeline Ferrell, M.D. (Chicago, 1991); Mary Garcia, M.D. (Texas at Houston, 1991); Connie Jones, M.D. (North Carolina at Chapel Hill, 1991); Sheree Krigsman, M.D. (New York, 1985); Sarah Lisanby, M.D. (Duke, 1991); Robert Millet, M.D. (Louisiana, 1991); Nicholas Potts, M.D. (Flinders, South Australia, 1988); Lori Schweickert, M.D. (Creighton, 1991); Charlie Swanson, M.D. (Indiana, 1991); Shayne Tomisato, M.D. (Baylor, 1991); Susan Van Meter, M.D. (Oklahoma, 1991); Robert White, M.D. (Kentucky, 1991).

First Year Residents: Barbara Burtner, M.D. (Virginia, 1992); Greg Clary, M.D. (Texas, 1992); Tracey Holsinger, M.D. (Virginia, 1992); Doris Iarovici, M.D. (Yale, 1992); Julio Jane, M.D. (Unirem, 1985); Gurpreet Jawa, M.D. (North Carolina at Chapel Hill, 1992); Arif Kamran, M.D. (Pakistan, 1987); Myra McSwain, M.D. (Georgia, 1992); Elizabeth Murry, M.D. (Arkansas, 1992); Mark Vakkur, M.D. (Duke, 1992); Kendall Warden M.D. (Missouri, 1991); Vince Watts, M.D. (Oklahoma, 1992); Michelle Winn, M.D. (East Carolina, 1992).

Fellows: Lisa Block, M.D. (Emory, 1987); Rick Bowers, M.D. (Wright State, 1988); Toby DeWitt, M.D. (Michigan State, 1988); Douglas Gartrell, M.D. (Duke, 1987); Kathy Hickman, M.D. (Virginia 1989); Leslie Hocking, M.D. (Tufts, 1983); Vladimir Maletic, M.D. (Belgrade, 1981); Robert Richards, M.D. (East Carolina, 1988); Kasiraja Sathappan, M.D. (Madras, 1983); Jean Zula, M.D. (North Carolina at Chapel Hill, 1988).

Radiation Oncology

Residents: Jeffrey Acker, M.D. (Duke, 1989); Mary Elizabeth Hebert, M.D. (North Carolina at Chapel Hill, 1989); Sally Ingram, M.D. (North Carolina at Chapel Hill, 1988); Brian Kavanagh, M.D. (Tulane, 1988); Stephen King, M.D. (North Carolina at Chapel Hill, 1988); Sarah Kratz, M.D. (North Carolina at Chapel Hill, 1984); Justin Wu, M.D. (Duke, 1990).

Radiology

Residents: David T. Ahola, M.D. (Minnesota, 1991); Susan Anderson, M.D. (Med. Coll. of Virginia, 1990); Boyd Ashdown, M.D. (Utah, 1989); Jay A. Baker, M.D. (Duke, 1992); James W. Backstrom, M.D. (Pittsburgh, 1984); Chris Beaulieu, M.D. (Washington, 1989); Jonathan Breslau, M.D. (Case Western, 1988); Onie Bussey, M.D. (Harvard, 1990); Jessie Chai, M.D. (Harvard, 1989); Daniel A. Courneya, M.D. (Minnesota, 1991); George E. Crawley III, M.D. (East Carolina, 1988); Donna K. Culhane, M.D. (Nebraska, 1991); Mark DeLano, M.D. (Michigan State, 1989); Richard Duszak, Jr., M.D. (Pennsylvania State, 1989); Wayne M. Eberenz, M.D. (Pennsylvania, 1990); Charlotte Elenberger, M.D. (Med. Univ. South Carolina, 1989); Avery J. Evans, M.D. (Duke, 1989); Jeff L. Fidler, M.D. (Nebraska, 1988); Eric J. Finical, M.D. (Texas, Southwestern, 1988); Emily K. Folz, M.D. (Washington Univ., 1988); Imre Gaal, M.D. (Dartmouth, 1991); Paula Y. George, M.D. (Kansas, 1988); Robert C. Gilkeson, M.D. (Case Western Reserve, 1989); Brigid A. Gordon, M.D. (Georgetown, 1991); Denise Hooper, M.D. (Michigan State, 1990); William T. Jacoby, M.D. (Ohio State, 1987); David Kallmes, M.D. (Massachusetts, 1989); Eileen B. Krieg, M.D. (Robert Wood Johnson, 1991); Sean J. Kuyper, M.D. (Washington, 1990); Frederick R. Long, M.D. (Yale, 1988); Sharon Mavros, M.D. (Duke, 1989); Charles M. Maxfield, M.D. (Dartmouth, 1988); Steven Maxfield, M.D. (Duke, 1989); Carolyn Maynor, M.D. (Duke, 1989); Joseph W. Melamed, M.D. (Yale, 1990); Robert J. Optican, M.D. (Washington Univ., 1988); Joel R. Rainwater, M.D. (Texas-Southwestern, 1991); Jeffrey J. Rice, M.D. (Duke, 1992); Mark T. Ridinger, M.D. (Illinois, 1990); Elizabeth Rush, M.D. (Arkansas, 1990); Charles Soderstrom, M.D. (Texas-Southwestern, 1990); David K. Spencer, M.D. (Case Western Reserve, 1989); John A. Strong, M.D. (Michigan, 1988); Laura Thomas, M.D. (Duke, 1990); William B. Veazey, M.D. (Johns Hopkins, 1990); Michael Webb, M.D. (Duke, 1989); Pamela Woodard, M.D. (Duke, 1990); Stephanie Young, M.D. (Duke, 1990).

Surgery

DIVISIONS OF GENERAL AND CARDIOTHORACIC SURGERY

Instructors and Teaching Scholars: Robert D. Davis, M.D. (California at Los Angeles, 1984); Gregory P. Fontana, M.D. (California at Los Angeles, 1984); David H. Harpole, M.D. (Virginia, 1984).

Instructors and Chief Residents: Gene D. Branum, M.D. (Duke, 1986); Nancy J. Crowley, M.D. (Duke, 1985); Joseph R. Elbeery, M.D. (Georgetown, 1985); J. Scott Kabas, M.D. (Duke, 1985); Mark D. Plunkett, M.D. (North Carolina at Chapel Hill, 1986); Phillip P. Shadduck, M.D. (California at Los Angeles, 1986).

Cardiothoracic Fellow: John C. Lucke, M.D. (St. Louis, 1985).

Research Fellows: Mark P. Anstadt, M.D. (Wright State, 1986); Ravi S. Chari, M.D. (University of Saskatchewan, Canada, 1989); Bradley H. Collins, M.D. (Duke, 1989); Giovanni Cucchiari, M.D. (University of Milan, Italy, 1983); J. Michael Dimaio, M.D. (Miami, 1987); Forrest B. Fernandez, M.D. (Michigan, 1989); Joseph M. Forbess, M.D. (Harvard, 1990); Neal D. Hillman, M.D. (Colorado, 1987); Weiping Li, M.D. (Institute of Basic Medical Science, Beijing, 1989); John C. Magee, M.D. (Jefferson, 1988); Carmelo A. Milano, M.D. (Chicago, 1990); Clarence H. Owen, M.D. (Duke, 1989); R. Antonio Perez-Tamayo, M.D. (Chicago, 1990); David S. Peterseim, M.D. (Washington Univ., 1988); Scott K. Pruitt, M.D. (Columbia, 1987); Lynne A. Skaryak, M.D. (Duke, 1989).

Senior Assistant Residents: Paul M. Ahearne, M.D. (Duke, 1988); Hartmuth B. Bittner, M.D. (University of Heidelberg, 1989); Thomas A. D'Amico, M.D. (Columbia, 1987); Andrew M. Davidoff, M.D. (Pennsylvania, 1987); Stanley A. Gall, M.D. (Duke, 1987); Jeffrey S. Heinle, M.D. (Pittsburgh, 1987); Scott H. Johnson, M.D. (Duke, 1986); Allan D. Kirk, M.D. (Duke, 1987); Kevin P. Landolfo, M.D. (University of Manitoba, 1985); James R. Mault, M.D. (Michigan, 1988); Cary H. Meyers, M.D. (Chicago, 1988); Jeffrey C. Pence, M.D. (New York Med. Coll., 1986); William N. Peugh, M.D. (Washington Univ., 1990); Cemil M. Purut, M.D. (Duke, 1987); Lewis B. Schwartz, M.D. (Chicago, 1987); Mark W. Sebastian, M.D. (Rush, 1987); Mark Tedder, M.D. (Duke, 1988); Christina R. Weltz, M.D. (Pennsylvania, 1989).

Assistant Residents: Jeff D. Almand, M.D. (Tulane, 1991); Frank V. Aluisio, M.D. (Emory, 1991); Mary T. Amato, M.D. (Duke, 1991); David L. Cannon, M.D. (Cornell, 1991); Christine A. Cheng, M.D. (Duke, 1991); Bryan M. Clary, M.D. (California at San Francisco, 1991); Adrian H. Cotterell, M.D. (Duke, 1991); Louis R. Dibernardo, M.D. (Duke, 1991); Kevin M. Doyle, M.D. (Duke, 1991); Philip Henkin, M.D. (Ohio State, 1991); Charles L. Herring, M.D. (Hahnemann, 1991); Eric D. Hoffman, M.D. (Duke, 1991); Paul M. Kirshbom, M.D. (Johns Hopkins, 1991); Scott D. Mair, M.D. (Duke, 1991); Christopher R. Mantyh, M.D. (Wisconsin, 1991); Thomas P. McDermott, M.D. (Duke, 1991); Gregory S. Motley, M.D. (Kentucky, 1991); Joseph Neighbors, M.D. (Med. Coll. of Virginia, 1990); Joseph R. Perno, M.D. (Duke, 1990); Stephen B. Potts, M.D. (Duke, 1991); Neal J. Prendergast, M.D. (Case Western Reserve, 1991); Scott C. Silvestry, M.D. (Pennsylvania, 1991); James T. Wright, Jr., M.D. (Southwestern, 1990).

First Year Residents: Michael L. Beckish, M.D. (Minnesota, 1992); Michael E. Berend, M.D. (Duke, 1992); Christian P. Christensen, M.D. (Vanderbilt, 1992); Eric L. Cole, M.D. (Duke, 1992); Brian M. Crites, M.D. (Indiana, 1992); Larkin J. Daniels, M.D. (Alabama, 1992); James J. Davidson, M.D. (Duke, 1992); Eric M. Gabriel, M.D. (Robert Wood Johnson, 1992); Maria S. Gottfredsdottir, M.D. (University of Iceland, 1989); Charles W. Hoopes, M.D. (Duke, 1992); Jeffrey J. Lawson, M.D. (Vermont, 1992); Vivian S. Lee, M.D. (Harvard, 1992); R. Eric Lilly, M.D. (Duke, 1992); Shu S. Lin, M.D. (Duke, 1992); Brian C. Murphy, M.D. (Duke, 1992); Jeffrey A. Murray, M.D. (Virginia, 1992); Thomas J. Noonan, M.D. (Duke, 1992); Brian P. Perry, M.D. (Nebraska, 1992); Jonathan G. Sorohan, M.D. (Med. Coll. of Georgia,

1992); James D. St. Louis, M.D. (Georgetown, 1992); Jeffrey E. Taber, M.D. (Duke, 1992); Bryan C. Weidner, M.D. (Pennsylvania, 1992); Clifford R. Wheelles, M.D. (North Carolina at Chapel Hill, 1992).

DIVISION OF NEUROSURGERY

Instructors and Chief Residents: Daryl Warder, M.D. (Johns Hopkins, 1987); Jacob N. Young, M.D. (Duke, 1986).

Assistant Residents: Robert E. Cashman, M.D. (Oklahoma, 1991); Richard M. Foltz, M.D. (Texas Tech., 1988); Sarah J. Gaskill, M.D. (Texas, Health Sciences Ctr., 1988); Bermans J. Iskandar, M.D. (Pennsylvania, 1989); Monica W. Loke, M.D. (Chicago, 1988); James R. Nashold, M.D. (East Carolina, 1990); Christopher G. Paramore, M.D. (Duke, 1987); John H. Sampson, M.D. (Canadian Medical School, 1990); Kasia Van Pett, M.D. (Stanford, 1991).

DIVISION OF ORTHOPAEDIC SURGERY

Instructors and Chief Residents: Brett C. Barnes, M.D. (Baylor, 1987); Margaret S. Cheng, M.D. (Duke, 1987); Samuel S. Fleming, M.D. (Med. Coll. of Georgia, 1987); Langdon A. Hartsock, M.D. (Duke, 1987); Claude T. Moorman III, M.D. (Cincinnati, 1987); George A. C. Murrell, M.B., B.S. (Adelaide Univ., Australia, 1983); Thomas A. Schroeter, M.D. (Bowman Gray, 1987); Steven C. Winters, M.D. (New Jersey, 1987).

Assistant Residents: Deanna M. Boyette, M.D. (East Carolina, 1988); Philip G. Coogan, M.D. (Vanderbilt, 1988); James D. Dalton, Jr., M.D. (Duke, 1990); David T. Dellaero, M.D. (Baylor, 1990); Timothy E. Dicke, M.D. (Ohio, 1985); John A. Fox, M.D. (Columbia, 1989); Robert L. Friedman, M.D. (California at Los Angeles, 1988); John H. Gerhard, M.D. (Harvard, 1981); James E. Gilbert, M.D. (Georgetown, 1990); Jeffrey L. Herring, M.D. (Oklahoma, 1986); Scott R. Jacobson, M.D. (California at Los Angeles, 1988); Keith Kenter, M.D. (Missouri, 1990); Robert L. Kimber, M.D. (Emory, 1988); Robert C. Kime III, M.D. (Duke, 1989); Daniel D. Lahr, M.D. (Hahnemann, 1988); Charles M. LeCroy, M.D. (Duke, 1989); Robert E. Lins, M.D. (Michigan, 1988); Philip W. Mack, M.D. (California at Irvine, 1989); Richard M. Magill, M.D. (Temple, 1983); John B. Mason, M.D. (Med. Univ. of South Carolina, 1989); Robert D. Mastey, M.D. (Robert Wood Johnson, 1989); Bruce J. Montella, M.D. (Chicago, 1990); John H. Murray, M.D. (Virginia, 1990); Patrick J. Padilla, M.D. (California at Los Angeles, 1988); Michael L. Parks, M.D. (South Carolina, 1990); Scot E. Reeg, M.D. (Illinois, 1989); David A. Spiegel, M.D. (Duke, 1990); Robert J. Spinner, M.A. (Mayo, 1990); Cooper L. Terry, M.D. (Vanderbilt, 1989).

DIVISION OF OTOLARYNGOLOGY

Instructors and Chief Residents: Mark A. Armeni, M.D. (Ohio State, 1988); James E. Saunders, M.D. (Oklahoma, 1987); Robert A. Shumway, M.D. (Arizona, 1988).

Assistant Residents: Mark L. Hagood, M.D. (Alabama, 1989); F. P. Johns Langford, M.D. (Mississippi, 1989); Mark K. Lavigne, M.D. (East Carolina, 1990); Ben H. Lee, M.D. (Colorado, 1990); David W. Molter, M.D. (Duke, 1988); Arvinder S. Uppal, M.D. (Jefferson, 1990).

DIVISION OF PLASTIC AND MAXILLOFACIAL SURGERY

Instructors and Chief Residents: Steven G. Harris, M.D. (Duke, 1984);

Benson L. Timmons, M.D. (East Carolina, 1985); James C. Yuen, M.D. (Med. Coll. of Virginia, 1985).

Assistant Residents: Peter A. Aldea, M.D. (Columbia, 1983); Tad R. Heinz, M.D. (Duke, 1987); Nikolai R. Nikolov, M.D. (Louisville, 1986); Robert D. Rehnke, M.D. (Duke, 1986); Ranier E. Sachse, M.D. (Fredrick Alexander University, West Germany, 1983); Michael J. Sundine, M.D. (St. Louis, 1987).

DIVISION OF UROLOGY

Instructors and Chief Residents: Amir Z. Beshai, M.D. (California at Los Angeles, 1987); Thomas E. Keane, M.D. (Johns Hopkins, 1986); Keith D. Newman, M.D. (Texas A & M, 1987); Paul R. Young, M.D. (Connecticut, 1987).

Assistant Residents: Christopher L. Amling, M.D. (Oregon, 1985); Nathaniel Barnes, M.D. (Harvard, 1989); Roland M. Friedman, M.D. (Med. Coll. of Virginia, 1988); Jeffrey R. Gingrich, M.D. (Michigan, 1987); George K. Ibrahim, M.D. (Duke, 1988); William W. Kerfoot, M.D. (South Florida, 1985); Jay H. Kim, M.D. (Boston, 1989); Kelly E. Maloney, M.D. (Dalhousie Univ., 1990); Luis M. Perez, M.D. (Albert Einstein, 1988); David T. Price, M.D. (Louisiana, 1989); Albert Ruenes, M.D. (Columbia, 1988); John A. Wiener, M.D. (Tulane, 1988); Paul R. Young, M.D. (Connecticut, 1987).

Research Fellow: Micaela Aleman, M.D. (Baylor, 1990).

ROSTER OF STUDENTS

Class of 1993

Ahmed, Yasmath F. (Massachusetts Institute of Technology), Binghamton, New York
Ahuja, Nita (Maryland), McLean, Virginia
Alexander, Kelly A. (Duke), Gainesville, Florida
Altman, Kenneth W. (Illinois), Durham, North Carolina
Areford, Matthew L. (Hampden-Sydney), Jacksonville, Florida
Backus, Mark A. (Stanford), Seattle, Washington
Barry, Todd Skipper (North Carolina at Chapel Hill), Chapel Hill, North Carolina
Boockvar, Kenneth S. (Harvard), Woodmere, New York
Bowens, Clifford, Jr. (Illinois), Durham, North Carolina
Bright, David K. (Otago), Durham, North Carolina
Carruth, Mark R. (Tulane), Largo, Florida
Chandler, Paulette D. (Princeton), Upper Marlboro, Maryland
Chao, Richard C. (Duke), Fayetteville, North Carolina
Cihak, Robert A. (Notre Dame), Clarkston, Washington
Clark, Christopher T. (California at Berkeley), Durham, North Carolina
Clement, Rita A. (Union), Webster, New York
Coles, Robert E. (Harvard), Durham, North Carolina
Cooper, Howard A. (Harvard), New Rochelle, New York
Cunnion, Kenji M. (Dartmouth), Durham, North Carolina
Day, Steven E. (Duke), Gastonia, North Carolina
Dean, Gregory S. (North Carolina State), Raleigh, North Carolina
Dees, Elizabeth C. (Princeton), Alexandria, Virginia
Dimsdale, Jason, M. (Wofford), Sylva, North Carolina
Donnelly, Daniel S. (Virginia Tech), Newfoundland, New Jersey
Dorman, Susan E. (Trinity), Durham, North Carolina
Ducey, Anne L. (Notre Dame), Endwell, New York
Early, Bridget P. (N.E. Missouri State), Chapel Hill, North Carolina
Ervin, Christopher E. (Furman), College Park, Georgia
Felker, Gary M. (Southern Methodist), Ft. Smith, Arizona
Flynn, Michael K. (Brown), Durham, North Carolina
Forman, Mark S. (Yale), Great Neck, New York
Gilman, Eugenia M. (Princeton), Cullowhee, North Carolina
Gingrich, Jay A. (Kansas), Fairway, Kansas
Gravatt, Lee C. (Duke), Rockville, Maryland
Green, Robert J. (Duke), Palm Beach, Florida
Greene, Deborah R. (City College of New York), Jamaica, New York
Ha, Van T. (Georgetown), Springfield, Virginia
Hammes, Stephen (Cornell), Durham, North Carolina
Haplea, Seth S. (Vanderbilt), Huron, Ohio
Hartman, Jeffrey S. (Iowa), Ames, Iowa
Heck, Donald V. (Wake Forest), Clemmons, North Carolina
Hegde, Sanjay S. (Duke), Tallahassee, Florida
Herbsman, Oded (Florida), Durham, North Carolina
Hsu, Jordan C. (Duke), Rockville, Maryland
Hyer, Randall N. (United States Naval Academy), Los Alamos, New Mexico
Idriss, Salim F. (Duke), Sturgis, Michigan
Jamieson, Denise (Pennsylvania), Lake Wylie, South Carolina
Jayawant, Amar Mark A. (Duke), Hockessin, Delaware
Jerome, Keith R. (Georgetown), Ashland, Kentucky
Jordan, Lyndon K, III (Duke), Smithfield, North Carolina
Kaplan, Andrew M. (Amherst), Framingham, Massachusetts
Kaufman, Jeffrey (New York at Stony Brook), Plainview, New York
Kelly, Larry W. (Duke), Durham, North Carolina
Kemper, Alex R. (Johns Hopkins), Fort Lauderdale, Florida
Knerr, Sheila Martineau (William and Mary), Suffern, New York
Kocher, Mininder S. (Dartmouth), Penfield, New York
Kottra, Jennifer J. (Stanford), Anchorage, Alaska
Landau-Levine, Mary Elizabeth (North Carolina at Chapel Hill), Durham, North Carolina
Lee, Steve K. (Illinois), Palatine, Illinois
Levine, Todd D. (Haverford), Durham, North Carolina
Levy, Jill R. (Dartmouth), Syosset, New York
Lewis, Cleveland W., Jr. (North Carolina at Chapel Hill), Wilson, North Carolina
Li, Anson S. (Manitoba), Raleigh, North Carolina
Li, Robert A. (California at Los Angeles), Rancho Palos Verdes, California

Lilly, Edward G., III (Davidson), Raleigh, North Carolina
 Lodge, Andrew J. (Virginia), Trenton, New Jersey
 Lukes, Andrea S. (Duke), Asheville, North Carolina
 MacDougall, Michael J. (Wisconsin), Durham, North Carolina
 Marx, Christine E. (Swarthmore), Philadelphia, Pennsylvania
 Massey, Marga F. (Duke), Elizabeth City, North Carolina
 Maurer, Erik J. (Wisconsin), Marshfield, Wisconsin
 McInnes, John S. (Carnegie Mellon), Claymont, Delaware
 Miller, Jeanne E. (North Carolina State), Charlotte, North Carolina
 Muir, Andrew J. (Trinity), Lenexa, Kansas
 Muly, Emil C., III (Johns Hopkins), Durham, North Carolina
 Osborn, Barbara H. (Brown), Philadelphia, Pennsylvania
 Palmer, Scott M., Jr. (Oberlin), Indian Mills, New Jersey
 Patterson, Lisa F. (Emory), Durham, North Carolina
 Pauk, John S. (Oberlin), Durham, North Carolina
 Pete, Karl L. (William and Mary), Kenner, Louisiana
 Pracyk, John B. (Duke), Oak Brook, Illinois
 Reece, Gerry L. (Emory), Woodstock, Georgia
 Rich, Jeremy N. (Washington), Bethesda, Maryland
 Roddenberry, John E. (Georgia), Macon, Georgia
 Roe, Matthew T. (Virginia), Reston, Virginia
 Ross, Barbra A. (California at Berkeley), New York, New York
 Rubenstein, David S. (Princeton), Durham, North Carolina
 Saperstein, Lawrence A. (Duke), Durham, North Carolina
 Scher, David M. (Brown), South Orange, New Jersey
 Schuster, James (South Dakota), Rapid City, South Dakota
 Shaw, Heather S. (Harvard), Wilmington, North Carolina
 Shi, Patricia A. (Johns Hopkins), Buffalo, New York
 Sicard, Michael W. (South Florida), Ormond Beach, Florida
 Sidbury, Robert (Duke), Deale, Maryland
 Smart, Brian A. (Washington), Garrett Park, Maryland
 Smith, Timothy W. (Duke), Greensboro, North Carolina
 Somers, Mark J. (Yale), Kettering, Ohio
 Stanley, Samuel D. (Duke), Durham, North Carolina
 Steinberg, Leonard A. (Emory), Doraville, Georgia
 Stidham, Katrina R. (Duke), Knoxville, Tennessee
 Strong, Sharon M. (Pittsburgh), Pittsburgh, Pennsylvania
 Taylor, Donald M. (Duke), Chapel Hill, North Carolina
 Ting, David Y. (Duke), Durham, North Carolina
 Tong, Frank C. (Texas at Austin), Durham, North Carolina
 Tong, Phyllis Sou-Wen (Duke), Morgantown, West Virginia
 Vance, Charles R. (Princeton), Durham, North Carolina
 Ventimiglia, Joe B. (Dartmouth), Chapel Hill, North Carolina
 Verghese, George M. (Duke), Raleigh, North Carolina
 Walton, Terrence W. (University of the South), Huntsville, Alabama
 Watke, Christopher M. (Duke), Sacramento, California
 Watts, Greta Y. (Miami), Burgaw, North Carolina
 Weiner, Michael (Brown), New York, New York
 Wenzel, Frederick G., IV (Davidson), Clyde, North Carolina
 Whitaker, Elizabeth G. (Davidson), Durham, North Carolina
 Wigod, Mark D. (California at Berkeley), Long Beach, California
 Wray, Dannah W. (Warren Wilson), Fayetteville, North Carolina
 Zellman, Glenn L. (Duke), Oceanside, New York
 Zempolich, Karen A. (Duke), Lanham, Maryland
 Zipprich, Diane A. (Notre Dame), Hopewell Junction, New York

Class of 1994

Aaron, Rosemary Hunter (Emory), Durham, North Carolina
 Anderson, Karen Sue (Virginia), Wilmington, Delaware
 Arnder, Lance L. (North Carolina State), Durham, North Carolina
 Arnold, Walter D., Jr. (Virginia), Bristol, Tennessee
 Avva, Ravisankar R. (North Carolina at Chapel Hill), Durham, North Carolina
 Bachman, Eric S. (Cornell), Tonawanda, New York
 Banit, Daxes M. (Emory), Tucker, Georgia
 Barbee, Daniel G. (William and Mary), Lumberton, North Carolina
 Bazar, Kimberly A. (Cornell), Middlefield, Connecticut
 Benjamin, Arthur (Cornell), Miami Beach, Florida

Blair, David R. (Georgetown), Sterling, Virginia
 Blobe, Gerard C. (Notre Dame), Coopersburg, Pennsylvania
 Bowman, Brian P. (Tampa), Durham, North Carolina
 Bowman, Brock K. (Johns Hopkins), Los Gatos, California
 Britt, James W. (North Carolina at Chapel Hill), Durham, North Carolina
 Britt, John C. (North Carolina at Chapel Hill), Durham, North Carolina
 Brown, Rachel A. (Emory), New Orleans, Louisiana
 Bullard, Steven R. (Brown), Charlotte, North Carolina
 Buranosky, Raquel A. (Georgetown), Franklin, Pennsylvania
 Cabell, Christopher H. (Pennsylvania State), Durham, North Carolina
 Chai, Paul J. (Duke), Holmdel, New Jersey
 Chen, Frederick (Wisconsin), Marshfield, Wisconsin
 Chu, Charleen T. (Harvard), Carson, California
 Clark, Carolyn A. (Rhode Island), Durham, North Carolina
 Clark, Dwayne C. (United States Naval Academy), Hialeah, Florida
 Colvin, Richard A. (Cornell), Virginia Beach, Virginia
 Dugas, Jeffrey R. (North Carolina State), Charlotte, North Carolina
 Eaton, James Van (Duke), Durham, North Carolina
 El-Shammaa, Emile N. (Maryland Eastern Shore), Rockville, Maryland
 Eng, Michael A. (Maryland), Cooksville, Maryland
 Esposito, David J. (Yale), Milford, Connecticut
 Fard, Arman K. (Pennsylvania), King of Prussia, Pennsylvania
 Fields, Michael J. (Pennsylvania), Silver Spring, Maryland
 Fields, Timothy A. (Chicago), Crowley, Louisiana
 Floberg, Dane R. (Colorado), Englewood, Colorado
 Fortuin, Brian W. (California at Santa Barbara), Danville, California
 Friedman, Tony (Harvard), Brooklyn, New York
 Fromer, Eric S. (Virginia), McLean, Virginia
 Ganchi, Parham A. (Princeton), Wayne, New Jersey
 Gerke, Calvin G., Jr. (Texas at Austin), Durham, North Carolina
 Gillespie, Richard R., Jr. (Lenoir-Rhyne), Charlotte, North Carolina
 Goldstein, Jeffrey B. (Duke), Bridgewater, New Jersey
 Grigg, Diane M. (Duke), Rock Hill, South Carolina
 Harrison, Cary Elizabeth (New Mexico), Durham, North Carolina
 Hasselman, Carl T. (Pittsburgh), St. Marys, Pennsylvania
 Hasty, Christopher C. (North Carolina at Chapel Hill), Durham, North Carolina
 Haura, Eric B. (Johns Hopkins), Bridgewater, New Jersey
 Henn, Jeffrey S. (Ohio State), Kirtland, Ohio
 Hester, Mark A. (Duke), Elizabethtown, North Carolina
 Higgins, Pete Doyle (Duke), Durham, North Carolina
 Hoffman, Robert D. (Florida), Jacksonville, Florida
 Holmes, Jude, Jr. (North Carolina at Chapel Hill), Maple Hill, North Carolina
 Howard, Gayle C. (California at San Diego), Durham, North Carolina
 Huang, David Y. (Duke), Carrboro, North Carolina
 Huang, Patti C. (Duke), Chapel Hill, North Carolina
 Hunter, Jennifer L. (Duke), Durham, North Carolina
 Kauffman, Kimberly S. (Virginia), Titusville, New Jersey
 Kaynan, Aval M. (Pennsylvania), Holliswood, New York
 Kenan, Daniel J. (William and Mary), Durham, North Carolina
 Keogh, Maureen L. (Duke), Norwalk, Connecticut
 Keogh, Patricia E. (Duke), Norwalk, Connecticut
 Kevill, Katharine A. (Williams), Babylon, New York
 Kirk, Kevin P. (South Carolina), Herkimer, New York
 Knaut, Andrew L. (Duke), El Paso, Texas
 Kraus, John E., Jr. (Florida), Cherry Hill, New Jersey
 Lee, David M. (Stanford), Fosston, Minnesota
 Lee, Maggie C. (Yale), San Pedro, California
 Lee, Robert E., III (Notre Dame), Indianapolis, Indiana
 LeMosy, Ellen K. (Florida), Melbourne, Florida
 Lucas, Gregory M. (Notre Dame), Deerfield, Illinois
 Lynch, John R. (Brown), Grafton, Virginia
 Malchow, Steven C. (Washington), St. Louis, Missouri
 Mass, Steven C. (Vanderbilt), Plantation, Florida
 Massing, Mark W. (Florida Atlantic), Chapel Hill, North Carolina
 Maybodi, Mitra (Iowa), Durham, North Carolina
 McFarland, Barbra Jill (Duke), Indian Wells, California
 McMann, Amy E. (Duke), Chevy Chase, Maryland

McSwain, Mark W. (Virginia Military Institute), Wilmington, North Carolina
 Mehran, Amir-Hossein (Brown), Tehran, Iran
 Mellin, Andrew F. (Cornell), Fort Lauderdale, Florida
 Melnick, Jeffrey R. (Princeton), Danville, Virginia
 Monks, John E. (Tufts), Holden, Massachusetts
 Murata, Yoshihiko (Stanford), Durham, North Carolina
 Murthy, Thippeswamy H. (Case Western Reserve), Pittsburgh, Pennsylvania
 Nash, S. Russell (Wake Forest), Belton, South Carolina
 Nazaire, Fausta (Wellesley), Queens Village, New York
 Oury, Tim D. (Purdue), Valparaiso, Indiana
 Padin, Cheryl J. (Duke), Durham, North Carolina
 Pak, Wanda (Duke), Durham, North Carolina
 Paolini, John F. (Tulane), New Orleans, Louisiana
 Payne, George B. (Brown), Durham, North Carolina
 Pickar, Amy E. (Pennsylvania), Maitland, Florida
 Piglia, Lisa M. (North Carolina at Chapel Hill), Durham, North Carolina
 Piller, Christopher P. (Hobart), Cobleskill, New York
 Quan, Long T. (Indiana), Indianapolis, Indiana
 Register, Brian S. (Morehouse), Sumter, South Carolina
 Rimmele, Frederick C., III (Amherst), Clifton, New Jersey
 Roland, Frank H., Jr. (Pennsylvania), Houston, Texas
 Rouleau, Peggy A. (James Madison), Durham, North Carolina
 Sam, Albert D. (Morehouse), New Orleans, Louisiana
 Schaffer, James W. (Duke), Huntersville, North Carolina
 Schneider, Andrew M. (Duke), Suffern, New York
 Schoenfeld, David E. (Cornell), Thiells, New York
 Schreiber, Jonathan L. (Stanford), Dix Hills, New York
 Sheifer, Stuart E. (Duke), Potomac, Maryland
 Siegfried, Marion E. (Pennsylvania State), Hilltown, Pennsylvania
 Smith, Darin S. (Indiana), Sandusky, Ohio
 Smothers, Chandra D. (Princeton), Memphis, Tennessee
 Sonny, Marya (Massachusetts Institute of Technology), Syosset, New York
 Spraggins, Yolanda (Pennsylvania), Detroit, Michigan
 Srebro, Sharon L. (North Carolina State), Durham, North Carolina
 Stambaugh, Lloyd E., III (Missouri), Hallsville, Missouri
 Stenftenagel, Judith A. (Indiana), Jasper, Indiana
 Stone, Kimberly Crapo (Brigham Young), Chapel Hill, North Carolina
 Sublett, Toni D. (California at Los Angeles), Durham, North Carolina
 Sumner, Sean M. (North Carolina at Chapel Hill), Scarborough, Ontario, Canada
 Swett, Jay W. (Dartmouth), Pittsburgh, Pennsylvania
 Thompson, Joff G. (Boston), Grand Forks, North Dakota
 Toth, Alison P. (Yale), New Fairfield, Connecticut
 Trauner, Michael A. (California at Los Angeles), Sunnyvale, California
 Tsai, Donald E. (Harvard), Bethesda, Maryland
 Turner, Michael B. (Vanderbilt), Clearwater, Florida
 Usadi, Moshe Mark E. (Yale), Durham, North Carolina
 Via, Dan F. (Duke), Durham, North Carolina
 Watson, Mark (Rice), Durham, North Carolina
 Wellington, Melanie A. (Brown), Landenberg, Pennsylvania
 Wong, Cindy V. (Princeton), Honolulu, Hawaii
 Woodard, Lawrence, Jr. (Morehouse), Grambling, Louisiana
 Woods, Christopher W. (Yale), Atlanta, Georgia
 Woolley, Charles T. (Cornell), Zionsville, Pennsylvania
 Wu, Richard C. (Duke), Salisbury, North Carolina
 Wurst, Eric A. (Duke), Durham, North Carolina
 Yelin, Julie B. (Texas at Austin), Houston, Texas
 Young, Timothy N. (Duke), Durham, North Carolina
 Yun, Joon K. (Harvard), Rockville, Maryland

Class of 1995

Aldous, Mark D. (North Carolina State), Burlington, North Carolina
 Aldridge, Howard K. (Emory), Covington, Georgia
 Allen, Diane M. (Vanderbilt), Lexington, Kentucky
 Allen, Quentin B. (Morehouse), Tampa, Florida
 Argenta, Peter A. (Michigan-Ann Arbor), Durham, North Carolina
 Atkins, Broadus Z. (North Carolina at Charlotte), Mt. Airy, North Carolina
 Baker, Carol I. (Virginia), Charlotte, North Carolina

Ballard, Timothy C. (Harvard), Scarsdale, New York
 Belmont, Philip J., Jr. (United States Military Academy), Cincinnati, Ohio
 Berkowitz, Beth Jo (Cornell), Coral Gables, Florida
 Binder, Devin K. (Harvard), Berkeley, California
 Boulware, Leigh E. (Vassar), Cleveland Heights, Ohio
 Bowen, Patrick H. (Yale), Potomac, Maryland
 Bruno, Dieter (Duke), Durham, North Carolina
 Camacho, Daniel L. (Stanford), Gretna, Louisiana
 Chang, Christine (Duke), Torrance, Pennsylvania
 Chen, Daryl M. (Johns Hopkins), Kings Mountain, North Carolina
 Clarke, Scott R. (North Carolina at Chapel Hill), Chapel Hill, North Carolina
 Cothran, Roger L., Jr. (Duke), Marion, North Carolina
 Coviello, Andrea D. (Duke), Durham, North Carolina
 Dabal, Robert J. (North Carolina at Chapel Hill), Trinity, North Carolina
 Dar, Mohammed M. (North Carolina at Chapel Hill), Greenville, North Carolina
 Datto, Michael B. (Johns Hopkins), Cherry Hill, New Jersey
 Doty, Katherine G. (Mount Holyoke), Mendham, New Jersey
 Drachman, Douglas E. (Harvard), Concord, Massachusetts
 Drapkin, Anne L. (Dartmouth), Palo Alto, California
 Elkousy, Hussein A. (Duke), Chillicothe, Ohio
 Feingold, Steven A. (Yale), Scarsdale, New York
 Ferrier, Shona M. (North Carolina at Chapel Hill), Charlotte, North Carolina
 Flynn, Theresa McCarthy (Harvard), Durham, North Carolina
 Frucht, Michael M. (Virginia), Fort Washington, Maryland
 Gimbel, Michael L. (Cornell), Atlanta, Georgia
 Goodell, Maryellen R. (Cornell), Buffalo, New York
 Gorman, C. Nicole (Pennsylvania), Greensboro, North Carolina
 Gorske, Andrew C. (United States Military Academy), Fond du Lac, Wisconsin
 Gottsman, Michael B. (Duke), Glen Ellyn, Illinois
 Grewal, Ajita (Davidson), New Bern, North Carolina
 Grisson, Allen T. (Johns Hopkins), Florence, Alabama
 Hakanson, Robyn J. (Davidson), Durham, North Carolina
 Hall, William L. (California at San Diego), Durham, North Carolina
 Havrilesky, Laura J. (Williams), Durham, North Carolina
 Hayden, Michael N. (Iowa), Muscatine, Louisiana
 Hughes, George C., IV (Wake Forest), Durham, North Carolina
 Ingledue, Vickie Fowler (North Carolina at Chapel Hill), Crumpler, North Carolina
 Jenkins, Harvey C., Jr. (North Carolina at Chapel Hill), Fayetteville, North Carolina
 Johns, Jeffery S. (North Carolina at Chapel Hill), Charlotte, North Carolina
 Jones, Suzanne Eaton (Howard), Elmot, New York
 Kandzari, David E. (Duke), Morgantown, West Virginia
 Kent, Steven M. (Duke), Thomaston, Maine
 Kim, Patrick K. (Brown), Beckley, West Virginia
 Klenz, Mary E. (North Carolina at Chapel Hill), Charlotte, North Carolina
 Kumar, Jai R. (Vanderbilt), Cookeville, Tennessee
 Lane, Steven C. (North Carolina at Chapel Hill), Dunn, North Carolina
 Langdon, Lori M. (North Carolina State), Durham, North Carolina
 Lee, Linda H. (Smith), Glendale, Wisconsin
 Lenczowski, Joi M. (Tulane), Fairfax, Virginia
 Leonardo, Marc E. (Pennsylvania), Gladwyne, Pennsylvania
 Lin, Steven H. (Duke), Cary, North Carolina
 Louis, Nancy A. (Dartmouth), Brandon, Vermont
 Lunin, Scott D. (Washington), El Toro, California
 McAllister, Ann K. (Davidson), Wilmington, North Carolina
 Monroe, Andrea C. (Duke), Durham, North Carolina
 Moore, Nathaniel J. (Stanford), Elizabethtown, North Carolina
 Moran, Susan E. (Virginia), Severna Park, Maryland
 Morris, Alison M. (Harvard), North Dartmouth, Massachusetts
 Moynihan, Mark K. (Dartmouth), Worcester, Massachusetts
 Nichols, William G. (Virginia), Miami, Florida
 Norton, Carol B. (Wellesley), Dallas, Texas
 Norvell, Kristina E. (Yale), Potomac, Maryland
 Opperman, Amy D. (Duke), Solon, Ohio
 Owens, Harold P., Jr. (Morehouse), Kansas City, Kansas
 Passe, Theodore J. (Notre Dame), Wabasha, Minnesota
 Penczak, Gennifer Geller (Haverford), Manhasset, New York
 Perkins, Stephen L. (North Carolina State), Lillington, North Carolina

Petti, Cathy A. (Harvard), Nutley, New Jersey
 Posaw, Leila L. (Wellesley), Syracuse, New York
 Potts, Kevin E. (Missouri-Columbia), St. Louis, Missouri
 Pryor, Aurora D. (Duke), Durham, North Carolina
 Rajagopalan, Pradeep (Duke), Durham, North Carolina
 Rao, Geetha S. (Johns Hopkins), Murphy, North Carolina
 Recchia, Franco M. (Wayne State), East Detroit, Michigan
 Romp, Robb L. (Yale), Greensboro, North Carolina
 Routbort, Mark J. (Chicago), Darien, Illinois
 Ruiz, Robert E. (Akron-Main Campus), Durham, North Carolina
 Samy, Ravi N. (Duke), Wichita Falls, Texas
 Savarese, John J. (Holy Cross), Weston, Connecticut
 Schatte, Edward C. (North Carolina State), Garner, North Carolina
 Shah, Ketan D. (Emory), Charlotte, North Carolina
 Shawen, Scott B. (Brigham Young), Spokane, Washington
 Shiller, Andrew D. (Massachusetts Institute of Technology), Westport, Connecticut
 Skarada, Douglas J. (Cornell), Berwyn, Pennsylvania
 Smith, Peter J. (Notre Dame), Wilmette, Illinois
 Sperling, Robert T. (Stanford), San Rafael, California
 Steer, Dylan L. (Oberlin), Newton, Massachusetts
 Sue, Sean R. (Virginia), New York, New York
 Taylor, Michelle D. (Harvard), Oakland, California
 Thompson, Annemarie (Duke), Durham, North Carolina
 Tseng, Jennifer E. (Johns Hopkins), Shreveport, Louisiana
 Usadi, Rebecca S. (Rutgers), Durham, North Carolina
 Weissler, Marla (Duke), Key Biscayne, Florida
 Wenzel, Christopher T. (Davidson), Clyde, North Carolina
 Wilborn, Anita M. (Vanderbilt), Clarksville, Tennessee
 Woo, Emily J. (Swarthmore), Raleigh, North Carolina

Class of 1996

Advani, Anjali S. (Princeton), Durham, North Carolina
 Anthony, Evelyn Y. (North Carolina at Chapel Hill), Durham, North Carolina
 Arles, Stephen P. (Lafayette), Durham, North Carolina
 Axelrod, David A. (Harvard), Durham, North Carolina
 Baird, Paul T., Jr. (Duke), Potomac, Maryland
 Bernstein, Crystal L. (North Carolina at Chapel Hill), Durham, North Carolina
 Biswas, Shankha S. (North Carolina at Chapel Hill), Chapel Hill, North Carolina
 Boyd, Cynthia M. (Yale), Rumson, New Jersey
 Brenner, Louis (Yale), Peabody, Massachusetts
 Bulsara, Ketan R. (Davidson), Charlotte, North Carolina
 Busquets, Miguel A. (Harvard), Ponce, Puerto Rico
 Chambers, Robert A. (Centre), Campbellsville, Kentucky
 Chang, Albert S. (Michigan-Ann Arbor), Morgantown, West Virginia
 Chelminski, Ann N. (Duke), Chapel Hill, North Carolina
 Cheng, Elbert T. (Stanford), Mountain View, California
 Christ, Linda F. (United States Military Academy), Durham, North Carolina
 Chui, Stephen Y. (Stanford), Durham, North Carolina
 Clowse, Martin C. (Duke), Greensboro, North Carolina
 Crowley, Steven D. (Harvard), Columbus, Georgia
 Cusmariu, Jeffrey R. (Union), West Orange, New Jersey
 Dauterman, John F. (Duke), Raleigh, North Carolina
 Della Rocca, Gregory J. (Cornell), Castleton, New York
 Di Renzo, Gina (Notre Dame), Flanders, New Jersey
 DiCuccio, Michael N. (Duke), Durham, North Carolina
 Downey, William E., III (Duke), Durham, North Carolina
 Durgin, Harry W., Jr. (Duke), Huntsville, Alabama
 Ellis, Susan W. (Yale), Atlanta, Georgia
 Erens, Greg (Duke), Northbrook, Illinois
 Evanoff, Allison M. (Washington Jefferson), Seneca, Pennsylvania
 Flynn, Matthew K. (Harvard), Durham, North Carolina
 Galdino, Gregory M. (Pennsylvania State), Camp Hill, Pennsylvania
 Gamard, Christopher J. (Duke), New Orleans, Louisiana
 Gibbs, Beth L. (William Marsh Rice), Fort Bragg, North Carolina
 Gilliam, Lisa K. (Amherst), Durham, North Carolina
 Hage, William D. (Kenyon), Durham, North Carolina
 Haisley, Camille A. (Akron Main Campus), Canton, Ohio

Haque, Tehmina (Princeton), St. James, New York
 Hardacre, Jeffrey M. (Wisconsin at Madison), Marshfield, Wisconsin
 Hardee, Michael W. (North Carolina at Chapel Hill), Carrboro, North Carolina
 Hare, Charles B. (West Virginia), Morgantown, West Virginia
 Hepburn, Matthew J. (Duke), Ann Arbor, Michigan
 Horowitz, Neil S. (North Carolina at Chapel Hill), Gastonia, North Carolina
 Iacobucci, Mark J. (George Mason), Poquoson, Virginia
 Jacobs, James R. (Johns Hopkins), Durham, North Carolina
 Jacobs, Michael T. (South Florida), Bradenton, Florida
 Jones, Thomas E. (Boston), Billings, Montana
 Kadrmas, Warren R. (United States Air Force), Sheridan, Wyoming
 Kang, Esther H. (Wellesley), Canton, Ohio
 Kaplan, Seth D. (Cornell), Harriman, New York
 Kelly, Bryan T. (Brown), West Redding, Connecticut
 Kim, Dennis M. (Brown), White Oak, Pennsylvania
 Krol, Bryan J. (Indiana at Bloomington), Cincinnati, Ohio
 Lapp, Julie A. (Cornell), Durham, North Carolina
 Larson, Sara E. (Princeton), Dunwoody, Georgia
 Liao, Lawrence (Duke), Laurinburg, North Carolina
 Lynch, Kathryn J. (Catholic University of America), Chapel Hill, North Carolina
 Mansbach, Jonathan M. (Haverford), Memphis, Tennessee
 Marathe, Umesh S. (Duke), Amherst, New York
 Marshak, Jennifer D. (Pennsylvania), Dix Hill, New York
 Mauskopf, Alice E. (Cornell), Durham, North Carolina
 May, Christopher W. (Brown), Rochester, New York
 McGuire, Carla A. (Howard), Ithaca, New York
 Mefford, Ivan N. (Kentucky State), Germantown, Maryland
 Michelson, Kelly N. (Columbia), St. Louis, Missouri
 Moore, Lisa E. (Southern University A & M), Bastrop, Louisiana
 Morgan, Brian E. (Swarthmore), Nashotah, Wisconsin
 Mostaghel, Elahe A. (Harvard), Toledo, Ohio
 Nasser, Rima M. (Johns Hopkins), Baltimore, Maryland
 Neikirk-Pisto, Tawni L. (California at Los Angeles), Monterey, California
 Neimat, Joseph S. (Dartmouth), Potomac, Maryland
 Norris, Edward R. (Massachusetts Institute of Technology), Greenville, North Carolina
 Paydarfar, Joseph A. (Duke), Chapel Hill, North Carolina
 Pazin, John G. (Pennsylvania), Pittsburgh, Pennsylvania
 Pradhan, Archana A. (Princeton), Dix Hills, New York
 Prosnitz, Robert G. (Yale), Chapel Hill, North Carolina
 Putman, Shannon B. (Virginia), Chapel Hill, North Carolina
 Quarterman, Renee L. (Brown), Wilmington, Delaware
 Rao, Bhagwan J. (Johns Hopkins), Dunn, North Carolina
 Rothman, Russell L. (Duke), Albertson, New York
 Royster, Michael O. (Virginia), Burke, Virginia
 Shapiro, Leonid (Cornell), Rochester, New York
 Spencer, Edwin E., Jr. (North Carolina State), Wilmington, North Carolina
 Steele, Thomas M. (Oberlin), Corvallis, Oregon
 Stekler, Joanne D. (Williams), Bethesda, Maryland
 Sumner, William T. (Duke), Durham, North Carolina
 Tchau, Nadia K. (California at Berkeley), West Auburn, Maine
 Tevrizian, Allyson T. (Duke), Pasadena, California
 Trammel, Demaree L. (American), Rochester, New York
 Verbinski, Steven G. (Stanford), La Jolla, California
 Wang, Feng Lei (Princeton), Oak Ridge, Tennessee
 Weinberg, Jason B. (Princeton), Durham, North Carolina
 Weinberg, Mark A. (Yale), Boca Raton, Florida
 Williams, Eric A. (Boston), Durham, North Carolina
 Wimmer, Alan P. (Brigham Young), Logan, Utah
 Wong, Carolyn (Stanford), Walnut Creek, California
 Woods, Christine B. (Virginia), Raleigh, North Carolina
 Wu, Ming Y. (Stanford), Menlo Park, California
 Xanthakos, Stavra A. (Duke), Maumee, Ohio
 Yeh, Benjamin M. (Harvard), Tenafly, New Jersey
 Yeh, Mark M. (Dartmouth), Bakersfield, California
 Yelverton, Cheryl L. (California State-Northridge), Pacoima, California
 Yu, Paul B. (Stanford), El Cerrito, California

Class of 1992 with Postgraduate Year One Appointments

- Aaron, Mark F. (Millen, Georgia) Duke University Medical Center, Durham, North Carolina—Internal Medicine, Cardiology
- Armitage, John Brooks (Durham, North Carolina) University of Texas, Southwestern Medical School, Dallas, Texas—Clinical Pathology
- Aust, Michelle Renee (Apple Valley, Minnesota) The Mayo Clinic, Rochester, Minnesota—General Surgery, Otorhinolaryngology
- Axelson, David Alan (Pittsburgh, Pennsylvania) University of Pittsburgh, Pittsburgh, Pennsylvania—Psychiatry
- Baker, Jay Alan (Durham, North Carolina) Duke University Medical Center, Durham, North Carolina—Radiology
- Banks, Beth Ann (Brooklyn, New York) Good Samaritan, Phoenix Children's Hospital, Phoenix, Arizona—Medicine, Pediatrics
- Banson, Martin L. (Longmeadow, Massachusetts) Baystate Medical Center, Brigham and Women's Hospital, Boston, Massachusetts—Radiology
- Bates, Michael David (Rochester Hills, Michigan) Children's Hospital Medical Center, Cincinnati, Ohio—Pediatrics
- Berend, Michael E. (Columbus, Ohio) Duke University Medical Center, Durham, North Carolina—General Surgery, Orthopaedics
- Bouras, Ernest Peter (Jacksonville, Florida) Duke University Medical Center, Durham, North Carolina—Internal Medicine, Gastroenterology
- Bronstein, Seymour Maynard (Durham, North Carolina) Duke University Medical Center, Durham, North Carolina—Internal Medicine
- Byers, Jeffrey David (Tulsa, Oklahoma) Vanderbilt University Medical Center, Nashville, Tennessee—Internal Medicine, Dermatology
- Castellino, Sharon Marie (Matthews, North Carolina) Children's Hospital, Boston, Massachusetts—Pediatrics
- Catena, Thomas Gerard (Amsterdam, New York) San Diego Naval Hospital, San Diego, California—Internal Medicine
- Chen, Edward Po-Chung (Athens, Georgia) University of California, San Francisco, California—General Surgery
- Chen, Herbert (Marshfield, Wisconsin) Johns Hopkins Hospital, Baltimore, Maryland—General Surgery, Surgical Oncology
- Clapacs, John Terry II (Bloomington, Indiana) University of North Carolina—Internal Medicine, Emory University—Neurology
- Clyde, Brent L. (Simi Valley, California) University of Pittsburgh, Pittsburgh, Pennsylvania—General Surgery, Neurosurgery
- Cole, Eric Lowry (Durham, North Carolina) Duke University Medical Center, Durham, North Carolina—Otolaryngology
- Coleman, Lee R., Jr. (Miami, Florida) Medical University of South Carolina, Charleston, South Carolina—General Surgery, Cardiothoracic Surgery
- Cvijanovich, Natalie Zora (Winston-Salem, North Carolina) University of Utah, Salt Lake City, Utah—General Surgery
- Dalton, Thomas Maxwell (Springfield, Missouri) Massachusetts General Hospital—General Surgery, University of Florida Medical Center/Shands Hospital, Gainesville, Florida—Anesthesiology
- Davidson, James Joseph (Columbus, Ohio) Duke University Medical Center, Durham, North Carolina—Orthopaedic Surgery
- Deucher, Robert Leonard (Parma, Ohio) Duke University Medical Center, Durham, North Carolina—Internal Medicine, Primary Care
- Eck, John Bright (Corona del Mar, California) Virginia Mason Hospital—Transitional, Duke University Medical Center, Durham, North Carolina—Anesthesiology
- Edelberg, Jay Marshall (Baltimore, Maryland) Massachusetts General Hospital, Boston, Massachusetts—Internal Medicine, Cardiology
- Edwards, Paul Dominic (Raleigh, North Carolina) University of Florida, Gainesville, Florida—General Surgery, Plastic and Reconstructive Surgery
- Fisher, Andrew J. (Cleveland, Ohio) Barnes Hospital, Washington University, St. Louis, Missouri—Radiology
- Fisher, Marcus Stewart, Jr. (Elizabethtown, North Carolina) Wilford Hall USAF Medical Center, San Antonio, Texas—Pathology
- Gade, Karen (Boone, North Carolina) Mayo Graduate School of Medicine, Rochester, Minnesota—Internal Medicine, Physical Medicine and Rehabilitation

Gallup, Steven Brian (Raleigh, North Carolina) University of Pittsburgh, Montefiore Medical Center, Pittsburgh, Pennsylvania—Transitional, Emergency Medicine

Garfinkel, Marc Rider (Pittsburgh, Pennsylvania) University of California, San Diego, California—Surgery

Gazdag, Andre Robert (Sunnyvale, California) University of California, Los Angeles, California—Orthopaedics

George, Daniel James (Groveland, Massachusetts) Johns Hopkins Medical Institute, Baltimore, Maryland—Internal Medicine, Cardiology or Gastroenterology

Gordon, Helen Minifie (Chevy Chase, Maryland) Emory University, Atlanta, Georgia—Internal Medicine, Neurology

Graff, David Howard (Beaver Creek, Ohio) Duke University Medical Center, Durham, North Carolina—Internal Medicine

Greene, Karen Teal (West Hempstead, New York) Medical College of Georgia, Augusta, Georgia—Obstetrics and Gynecology, Maternal-Fetal Medicine

Guerin, Meghan Brady (Atlanta, Georgia) Post Graduate Training—Deferred

Hall, Bruce Lee (Warminster, Pennsylvania) Brigham and Women's Hospital, Boston, Massachusetts—General Surgery, Academic General Surgery

Henry, Mark H. (Arvada, Colorado) University of California, Los Angeles, California—Orthopaedics

Hernandez, Eugenio Javier (Coral Gables, Florida) Duke University Medical Center, Durham, North Carolina—Internal Medicine, Gastroenterology

Heskestad, Linda Marian (Dover, Massachusetts) Brigham and Women's Hospital, Boston, Massachusetts—Internal Medicine, Cardiology

Hoopes, Charles W. (Yarmouthport, Massachusetts) Duke University Medical Center, Durham, North Carolina—General Surgery, Urology

Huesgen, Christopher T. (Arlington Heights, Illinois) University of Louisville, Louisville, Kentucky—Emergency Medicine

Idriss, Marilyn McRitchie (Ann Arbor, Michigan) Duke University Medical Center, Durham, North Carolina—Pediatrics

Ince, Carlos S., Jr. (Hampton, New Jersey) Johns Hopkins Hospital, Baltimore, Maryland—Internal Medicine, Cardiology

Keller, V. Antoine (Los Angeles, California) Tulane University Medical Center, New Orleans, Louisiana—General Surgery, Cardiothoracic Surgery

Kim, Terry (Scarsdale, New York) California Pacific Medical Center—Internal Medicine, Emory University Medical Center—Ophthalmology

Klingensmith, Mary Emily (Beckley, West Virginia) Brigham and Women's Hospital, Boston, Massachusetts—General Surgery, Academic General Surgery

Klugherz, Bruce Douglas (Huntingdon Valley, Pennsylvania) Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania—Internal Medicine, Cardiology

Lancaster, Alisa Robinette (Gate City, Virginia) Duke University Medical Center, Durham, North Carolina—Pediatrics

Lasley, Elizabeth Hilton (Nashville, Tennessee) Children's National Medical Center, Washington, D. C.—Pediatrics

Lilly, R. Eric (Beckley, West Virginia) Duke University Medical Center, Durham, North Carolina—General Surgery, Cardiothoracic Surgery

Lim, Chang S. (Rockville, Maryland) University of Pennsylvania, Philadelphia, Pennsylvania—Internal Medicine

Lin, Shu S. (Arcadia, California) Duke University Medical Center, Durham, North Carolina—(General Surgery, Cardiothoracic Surgery)

Lloyd, Rhea Armagne (Potomac, Maryland) Washington Hospital Center—Internal Medicine, New England Eye Center/Tufts Medical Center—Ophthalmology

Lu, Mary Lien (San Marino, California) Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania—Internal Medicine, Dermatology

Marquis, Kimberly A. (Mendon, Massachusetts) University of Washington, Seattle, Washington—Internal Medicine, Hematology/Oncology

Mast, Alan Edward (Urbana, Illinois) Washington University, St. Louis, Missouri—Laboratory Medicine, Academic Medicine

Meissner, John David (Sutherland, Nebraska) Duke University Medical Center, Durham, North Carolina—Research in Molecular Biology, Surgical Oncology

Minahan, Robert Emmett, Jr. (Ft. Myers, Florida) Duke University Medical Center, Durham, North Carolina—Internal Medicine, Neurology

Moreadith, Jeffrey Hilburn (Reading, Pennsylvania) Duke University Medical Center, Durham, North Carolina—Medicine and Pediatrics

Murphy, Brian Christopher (Holtsville, New York) Duke University Medical Center, Durham, North Carolina—General Surgery, Urologic Surgery

Noonan, Thomas John (San Juan Capistrano, California) Duke University Medical Center, Durham, North Carolina—Orthopaedic Surgery

Oakley, Lisa Margaret (St. Louis, Missouri) St. John's Mercy Medical Center Transitional, University of California, San Diego, California—Radiology

Pao, Bing Shih (Raleigh, North Carolina) University of Colorado School of Medicine—Internal Medicine, University of California, San Diego, California—Emergency Room Medicine

Patton, Karen Lynelle (Moorestown, New Jersey) Brigham and Women's Hospital, Boston, Massachusetts—Internal Medicine

Pruthi, Raj Som (Boca Raton, Florida) Stanford University Medical Center, Stanford, California—General Surgery, Urology

Rajasinghe, Hiran A. (Englewood, New Jersey) University of California, San Francisco, California—General Surgery, Pediatric Cardiac Surgery

Reddy, Ashok Satty (Simpsonville, South Carolina) Emory University Medical Center, Atlanta, Georgia—General Surgery, Orthopaedic Surgery

Rice, Jeffrey Jack (San Angelo, Texas) Duke University Medical Center, Durham, North Carolina—Radiology

Ricci, William Michael (Woodbury, New Jersey) Santa Barbara Cottage Hospital—General Surgery, Hospital for Special Surgery—Orthopaedics

Royal, Vernice (Newton Grove, North Carolina) Medical College of Virginia, Richmond, Virginia—Internal Medicine

Sasser, David Charles (North Miami, Florida) David Grant USAF Medical Center, Travis Air Force Base, California—Family Medicine/ Aerospace Medicine

Shao, Spencer H. (Springfield, Virginia) Duke University Medical Center, Durham, North Carolina—Internal Medicine, Hematology/Oncology

Siderowf, Andrew David (Westport, Connecticut) Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania—Internal Medicine

Smith, Jill Ann (Buffalo, New York) Brigham and Women's Hospital—Internal Medicine, Massachusetts Eye & Ear Infirmary—Ophthalmology

Smith, Matthew Raymond (Lakeview, New York) Brigham and Women's Hospital, Boston, Massachusetts—Internal Medicine

Sonkin, Peter Laurence (Fayetteville, North Carolina) Roanoke Memorial Hospital—Transitional, University of Texas-Southwestern Medical Center—Ophthalmology

Stasheff, Steven F. (Lansdale, Pennsylvania) Children's Hospital of Philadelphia, Philadelphia, Pennsylvania—Pediatrics, Pediatric Neurology

Steiner, Theodore Scott (Coral Gables, Florida) Duke University Medical Center, Durham, North Carolina—Internal Medicine

Stenzel, Timothy Todd (Minneapolis, Minnesota) Duke University Medical Center, Durham, North Carolina—Academic Pathology

Stonnington, Michael J. (Richmond, Virginia) University of Florida, Shands Medical Center, Gainesville, Florida—Orthopaedics

Sung, Jane (Potomac, Maryland) Johns Hopkins Hospital, Baltimore, Maryland—Internal Medicine

Taber, Jeffrey Everett (El Paso, Texas) Duke University Medical Center, Durham, North Carolina—Urology

Tedder, Stephen D. (Greensboro, North Carolina) University of Texas-Southwestern Medical School—Ophthalmology

Tharrington, Christopher Leslie (Raleigh, North Carolina) Baptist Memorial Hospital, Memphis, Tennessee—Radiology

Vakkur, Mark (Durham, North Carolina) Duke University Medical Center, Durham, North Carolina—Psychiatry

Wallace, Michael Bradley (Durham, North Carolina) Brigham and Women's Hospital, Boston, Massachusetts—Internal Medicine

Walsh, Michael J. (Riverview, Michigan) St. Mary's Hospital—Internal Medicine, University of California, San Francisco, California—Anesthesiology

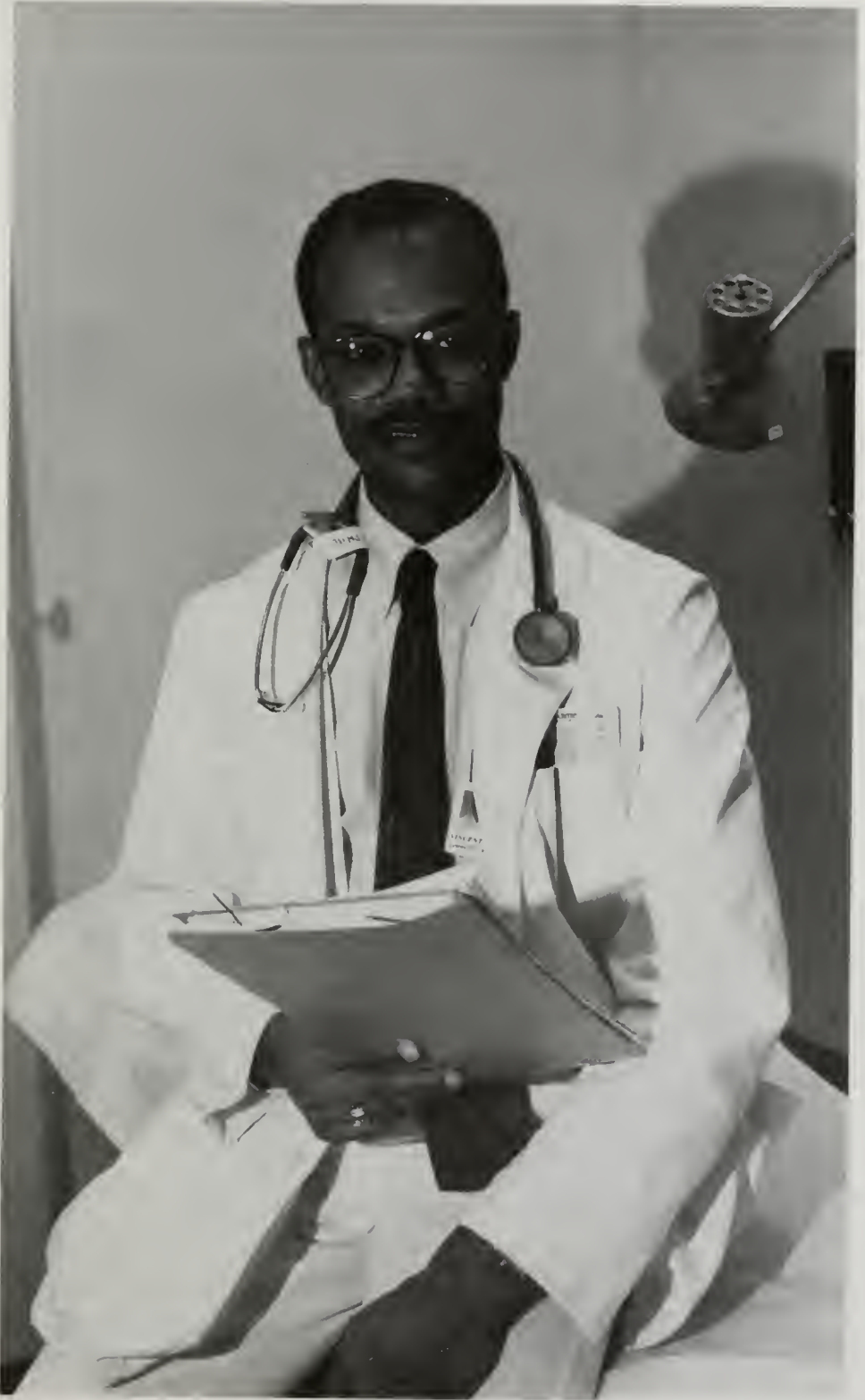
Wei, Maria (Ann Arbor, Michigan) Brigham and Women's Hospital, Boston, Massachusetts—Internal Medicine

Weidner, Alison Catherine (Allentown, Pennsylvania) Brigham and Women's Hospital, Boston, Massachusetts—Obstetrics and Gynecology

Wilson, Stephen J. (Santa Ana, California) Duke University Medical Center, Durham, North Carolina—Internal Medicine, Cardiology

Wyss, Stephan Paul (Manhattan Beach, California) San Mateo County General Hospital, San Mateo, California—Psychiatry

Yen, Stephanie Pei-Fang (Hanover, New Hampshire) Beth Israel Hospital–Internal Medicine, Duke University Medical Center, Durham, North Carolina–Radiology
Zakaria, Aamir Mohammad (Farmington, Connecticut) Vanderbilt University, Nashville, Tennessee–General Surgery



School of Nursing



The Master of Science in Nursing Program

The School of Nursing offers a program leading to the Master of Science in Nursing degree, which educates professional nurses for advanced practice in a clinical specialty or nursing administration. Graduates are prepared to function as clinical specialists in tertiary care settings as nurse practitioners in gerontology, or as mid-level nurse administrators in complex organizations.

The integration of education, practice, and research undergirds the entire curriculum and the behavior of those individuals involved in the educative process.

A graduate of the program will be expected to:

1. synthesize concepts and theories from nursing and related disciplines to form the basis for advanced practice;
2. demonstrate expertise in a defined area of advanced practice;
3. conduct scientific inquiry to validate and refine knowledge relevant to nursing;
4. demonstrate leadership and management strategies for advanced practice;
5. demonstrate proficiency in the use and management of advanced technology related to patient care and support systems;
6. analyze socio-cultural, ethical, economic, and political issues and develop strategies to influence the outcomes; and
7. demonstrate the ability to engage in collegial intra- and interdisciplinary relationships in the conduct of advanced practice.

A student may choose one of the following areas in which to specialize: (1) administration of nursing services; (2) critical care; (3) oncology; (4) gerontology; or, (5) pediatrics. Students pursue their educational endeavors with faculty and clinical/consulting associates who have expertise and research in the student's chosen area of specialization. Our curriculum is designed to provide maximum flexibility for full-time or part-time study.

General Curriculum Design

Theoretic Bases for Advanced Nursing Practice	3
Issues in Contemporary Health Care Organizations	3
Health Care Technology	3
Processes of Inquiry	6
Area of Specialization	
Content and Practice	12-18
Elective	3-6
Thesis (or) Nonthesis Option	<u>6</u>
Total	36-46

Admission Requirements

1. Bachelor's degree with an upper division nursing major from a program accredited by the National League for Nursing.
2. Minimum of one year's experience in area relevant to projected course of study for all specialties.
3. Undergraduate grade point average of 3.0 on a 4.0 scale.
4. Satisfactory performance on the Graduate Record Examination or Miller Analogies Test.
5. Satisfactory completion of course in descriptive and inferential statistics.
6. Eligibility to be licensed as a professional nurse in North Carolina.
7. Documentation of the acquisition of physical assessment knowledge and skills for those applicants choosing a clinical specialty.
8. Three references attesting to personal and professional qualifications. At least two references must be from former employers, faculty members, or deans.
9. Personal interview. Other arrangements may be considered when distance is a factor.

Selection will be based on the applicant's qualifications, intellectual curiosity, potential for professional growth, and contribution to the profession. Exception to any of these requirements will be considered on an individual basis.

Date for Application

An application for full-time study, with all supporting documents, must be submitted by 1 March for fall semester early admission. Applications for part-time study must be received by 1 March, 1 July, or 1 January. Students whose applications are completed after these dates will be offered admission only if space is available.

Courses

NUR-300. Theoretic Bases for Advanced Nursing Practice. Major components of nursing, health, persons, and environment are approached as the bases for advanced nursing practice in a complex health care center. Focus is on the analysis of relevant principles, theories, and issues for the synthesis of a framework for advanced nursing practice. 3 credits.

NUR-303. Issues in Contemporary Health Care Organizations. Survey of the key concepts and elements which form the basis for understanding the health care organization and the environment in which it exists. Theories and research supporting organizational structure processes and dynamics, and the impact of the financial/political constraints of the internal and external environment are discussed. The role of the master's prepared nurse is examined in relation to internal organizational dynamics. 3 credits.

NUR-306. Health Care Technology. An eclectic study of technological modalities used to assist in the diagnosis and treatment of patients, and in the management of information in health care systems, education, and research. Students have opportunities to engage in computer applications in selected learning experiences. The economic and ethical dilemmas inherent in the development and use of such sophisticated technologies are examined. 3 credits.

NUR-309. Processes of Inquiry I. Focuses on scientific inquiry and research methods needed for systematic investigation and expansion of nursing knowledge. The development of problem statements, organization of the literature review, considerations in design choice, and the relationship of design and statistical analyses are discussed in detail. 3 credits.

NUR-310. Processes of Inquiry II. Emphasizes the relationships among research design, methodology, and statistical techniques. Application and interpretation of statistical procedures will be studied in relation to the most common research designs used in health care and nursing. 3 credits.

NUR-320. Critical Care Nursing I. A perspective on selected developmental theories and patient and family responses to critical illness. Cardiovascular and respiratory problems, treatment, and technology as a basis for advanced nursing practice with adults are covered and the role of the clinical nurse specialist is introduced. Both didactic and clinical experiences are included. 4 credits.

NUR-322. Critical Care Nursing II. Focuses on complex problems, technology, and treatment of the renal, gastrointestinal, and neuroendocrine systems in adults as a basis for advanced nursing practice. 4 credits.

NUR-324. Clinical Care Nursing III. Focuses on (1) complex problems, technology and treatment of traumatic injury and multisystem failure as a basis for advanced nursing practice; (2) application of selected theories and skills in the critical care environment; and (3) implementation of the multiple roles of the critical care clinical nurse specialist, with special emphasis on the role of consultant. Didactic and clinical experiences and directed study are included. 4 credits.

NUR-330. Oncology Nursing I: Epidemiology and Pathophysiology. Focus is on epidemiology, pathophysiology and biobehavioral aspects of cancer across the life span of the adult years. Major topics include cancer physiology, prevention, detection, role of defenses, treatment, and responses to cancer. 3 credits.

NUR-332. Oncology Nursing II: Symptom and Problem Management. The ONS Guidelines for Oncology Nursing Practice serve as the framework for examination of potential problems and symptom management in cancer. Topics include knowledge deficit, information, coping, comfort, nutrition, protective mechanisms, mobility, elimination, sexuality, ventilation, and circulation. Case management is used in clinical practicum and seminars. 4 credits.

NUR-334. Oncology Nursing III: Clinical Specialist Residency. A clinical practicum in which students specialize in their interest areas, choosing among ambulatory/clinic care, inpatient care, bone marrow transplant care, community/preventive care, home care, hospice care and care of persons with HIV and AIDS. Case management, care maps, and ONS Guidelines for Oncology Nursing Practice serve as formats for the practicum and seminars. 5 credits.

NUR-340. Administration of Nursing Systems I. Focuses on the theoretical bases for developing and maintaining nursing systems in health care/health related institutions. Development of management skill serves as the basis for further inquiry and development of the nurse administrator role. Problem solving methodology is used to develop strategies for dealing with issues from the internal and external environment of health care institutions. 3 credits.

NUR-344. Administration of Nursing Systems II. Focuses on the theoretical bases of leadership in facilitating the development of professional nursing practice. Development, maintenance, and supervision of nursing systems in health care/health related institutions are discussed. Regulation and legal tenets from the external environment and their impact on the administration of nursing systems are emphasized. 3 credits.

NUR-345. Nursing Administration Residency. The residency builds upon the students' prior knowledge and experience in nursing administration. The intent is to develop independent problem solving skills under the guidance and mentorship of a practicing nurse

administrator. The minimum required credits are three with a maximum of nine credits for those needing additional learning experiences with a preceptor. 3-9 credits.

NUR-348. Budget Planning and Financial Management. Designed for managers in health care organizations. Focuses on the knowledge and skills needed by the nurse manager to plan, monitor, and evaluate budget and fiscal affairs for a defined unit or clinical division. Health care economics, personnel and patient activities are analyzed from a budgetary and financial management perspective within an environment of regulations and market competition. 3 credits.

NUR-370. Social Issues, Health and Illness in the Aged Years. Examines diversity in development and adaptation to environmental, social, psychological, and biological changes. Theories of aging, health and aging, intimacy, and sexuality, rural-urban health care patterns, minority health care patterns, demographic trends, and death and dying are discussed. 3 credits.

NUR-371. Assessment and Clinical Reasoning in Advanced Nursing Practice. Combines lecture and laboratory experiences to develop advanced skills in assessment of physical, cognitive, nutritional, and functional domains. Nurse patient interaction, data collection, and diagnostic reasoning are emphasized. The focus is on adults, with particular emphasis on the older adult. 3 credits.

NUR-372. Applied Pharmacology in Nursing Practice. Fundamentals of pharmacokinetics and pharmacodynamics necessary for clinicians to prescribe and monitor drug regimens used to treat acute and chronic illnesses in the elderly. Drug-nutrient interactions, problems related to self medication, and polypharmacy are also addressed. The rationale for specific drug selection is examined along with therapeutic and adverse effects. 1 credit.

NUR-373. Managing Common Chronic and Acute Health Problems of the Elderly. Emphasizes the management of chronic, acute, and common health problems in a variety of caregiving settings including ambulatory care, home health, and nursing home. Issues regarding transitions in care settings, family caregivers, case management, and care for homeless elderly are addressed. 4 credits.

NUR-374. Managing Care of the Frail Elderly. Emphasizes assessment, rehabilitation, and management of complex problems of elders who reside in community and institutional settings. Research projects and innovative care strategies are explored. Organizational and managerial effectiveness and consultative role of GNP/GCNS are examined. 4 credits.

NUR-375. GNP Post-Clinical Practicum. The residency provides GNP students with concentrated clinical opportunities. Emphasis is on clinical decision making, practice issues and organizational management. Residency sites and associated preceptors are arranged by faculty. 2-4 credits.

NUR-380. Advanced Concepts of Development and Pathophysiology in the Care of Children I. Infancy. Nursing management of children with complex problems associated with the cardiovascular system, genetic disease, neoplastic disease, immunopathology, and developmental disabilities, within the framework of developmental and family theory. Developmental issues related to birth and the first year of life, crisis theory and parental needs associated with child illness are included. 3 credits.

NUR-381. Advanced Concepts of Development and Pathophysiology in the Care of Children II. Toddler-Young School Age. Nursing management of children with complex problems associated with pulmonary, hemopoietic, central nervous system and endocrine systems within the framework of developmental and family theory. Developmental issues of toddlers through young school age children are included, as are special topics such as chronic illness, the threat of death, parental depression and the impact of illness on body image, school function and behavioral/learning disorders. 3 credits.

NUR-382. Advanced Concepts of Development and Pathophysiology in the Care of Children III. Older School Age and Adolescence. Nursing management of children with complex problems associated with the renal, gastrointestinal, bone-joint, and skin systems, within the framework of developmental and family theory. Developmental issues related to older school age adolescents are emphasized along with divorce, child abuse, and mental disorders of childhood. 3 credits.

NUR-383. Practicum in Advanced Pediatric Nursing Practice. Supervised clinical practicum exploring the role of the clinical nurse specialist in a pediatric setting of the student's choice. 3 credits.

NUR-350. Thesis. 6 credits.

NUR-351. Non-thesis Option. 6 credits.

NUR-399. Select Topics or Independent Study. 1-3 credits.

Electives. Courses to be offered as electives will be developed by the nursing faculty in addition to courses offered by other departments and schools within the university. Elective courses are to be supportive of the area of specialization. 3-6 credits.

NUR-360. Educational Concepts of Teaching and Learning. Focuses on the key concepts and principles which form the bases for the teaching and learning process. Educational theories of teaching and learning, situations, and issues serve as the framework for developing instructional strategies in advanced nursing practice roles. 3 credits.

NUR-362. Ethics in Nursing. Focuses on the historical development of ethics in nursing, analysis of moral language, codes of ethics, frameworks for ethical decision-making with case analysis, and strategies for discussion of ethics in nursing. 3 credits.

Nondiscrimination Policy

The Duke University School of Nursing admits students of any race, color, sex, religion, or national and ethnic origin to all programs and activities with the rights and privileges generally accorded or made available to students in the graduate school. It does not discriminate in the administration of its educational policies, scholarship and loan programs, or any other school-administered programs.

For additional information, please contact the Office of the Dean, Duke University School of Nursing, Box 3322, Durham, North Carolina 27710, (919) 684-3786.

The Allied Health Programs



The Allied Health Programs

There are several health-service related educational programs offered through the Division of Allied Health of the Duke University Medical Center that are neither medicine nor nursing. Currently, the Allied Health Division is comprised of three master's degree programs and several certificate programs. Every effort is made to keep each of these Allied Health programs closely related to the Medical School departments whose fields they serve. Today, there are approximately 277 students enrolled in such programs at Duke University. In addition, the School of Medicine is affiliated with two master's level programs that are administered through the Graduate School.

Resources for Study

All of the study facilities available to medical students are available to allied health students. See descriptions for Library/Communications Center, the Thomas D. Kinney Central Teaching Laboratory and Division of Audiovisual Education which may be found in a foregoing portion of this bulletin.

Several of the allied health programs have affiliations with other hospitals and medical institutions for clinical instruction.

Student Life

Living Accommodations. Because of the shortage of residential space, students enrolled in allied health certificate programs are not eligible for student housing. Student's enrolled in the Master's Programs, however, are eligible. The Department of Housing Management maintains a listing of rental apartments, rooms and houses provided by property owners or real estate agencies in Durham. These listings are available in the department only; during the summer an assistant is available to answer questions and aid

students in their attempt to obtain housing off campus. Information on commercial complexes in the Durham area may be obtained by writing to the Off-Campus Housing Office, 217 Anderson Street, Durham, NC 27705. Except for assuring that owners sign a statement of nondiscrimination, off-campus property is in no way verified and neither the University nor its agents negotiate between owners and interested parties. The search for accommodations should begin as soon as possible after acceptance. A visit of two or three days will allow you the opportunity to make use of the off-campus service and to inspect personally the availabilities.

Dining Facilities. Duke Dining Services operates a variety of dining facilities including cafeterias, snack bars, restaurants, salad bars, and more. Students may make food purchases in dining establishments with cash, or they may choose to open a pre-paid account. Information about the various types of accounts is available from The Duke Card Office, 024 Union West, Duke University, Durham, North Carolina 27706 919/684-5800.

Cafeterias operated by the hospital are available both in the medical center and the Veterans Administration Medical Center.

Student Financial Aid. Duke University recognizes the responsibility of students and their families to provide funds according to their ability to achieve the educational objective. Students are encouraged to pursue every available source of support through their local and state student assistance programs.

All programs are approved for veterans education benefits (G.I. bill) for those who are eligible. Some of the programs have limited student support available through stipends or special scholarships.

Financial aid is available through Duke in limited amounts in the form of loans. When all institutional funds are pooled, the amount available to a totally needy student is inadequate to meet the school's recognized costs. A Financial Aid Form (FAF) or a Graduate and Professional Schools Financial Aid Service (GAPSEAS) form from applicants and their parents (and spouse, if applicable) is required in addition to the Duke University Financial Aid Application. A copy of the student's (and spouse's, if applicable) federal income tax return for the previous taxable year is required. In the case of the dependent student, a copy of the parent's federal income tax return for the last taxable year is also required. Duke University reserves the right to decline to approve loan applications for those applicants who do not have a satisfactory credit history. U.S. citizenship or permanent residence visa is required of all students receiving loans through the school.

It is the responsibility of recipients of financial aid to keep the Medical Center Office of Financial Aid informed of any outside financial assistance they may receive. It must be understood that Duke reserves the right to reconsider its offer of financial assistance in the event of a major outside award to a recipient. No financial aid funds may be used during a period when the recipient is not involved with work toward the degree or certificate. Less than half-time or special students are not eligible for financial aid.

Students who have been accepted for matriculation routinely receive financial aid applications. Annual reapplication is required of all financial aid recipients.

Pell Grant (formerly BEOG) is a federally funded grant for students with financial need who have not earned a baccalaureate degree and are enrolled in any postsecondary educational program. To apply the applicant completes a Free Application for Federal Student Aid (FAFSAS) which may be obtained from a high school guidance counselor or any financial aid office.

North Carolina Student Incentive Grant (NCSIG) is available to residents of North Carolina who are enrolled in any postsecondary educational program in North Carolina. The applicant must demonstrate substantial financial need and must not have earned a baccalaureate degree. Application deadline is 1 March for the following academic year. To apply the applicant completes a Free Application for Federal Student Aid (FAFSAS) requesting that the information be sent to College Foundation, Inc., 1307 Glenwood Avenue, Raleigh, North

Carolina 27605. FAFSAs may be obtained from a high school guidance counselor or financial aid office.

North Carolina Student Loan Program for Health, Science, and Mathematics. These loans provide financial assistance to North Carolina residents who demonstrate need as determined by the board. Loans are available for study in the medical fields, mathematics, and science programs that lead to a degree. The applicant must be a domiciliary of North Carolina and accepted as a full-time student in an accredited associate, baccalaureate, master's, or doctoral program leading to a degree. Loan recipients in professional or allied health programs may cancel their loans through approved service in shortage areas, public institutions, or private practice. Medical students may receive up to \$7,500 per year for each of the four years; master's degree students are eligible for two loans of up to \$5,000 each; bachelor's degree students are eligible for three loans of up to \$4,000 each. For application forms and more information write: Executive Secretary, Board for Need-Based Student Loans, 116 West Jones Street, Raleigh, North Carolina 27605, or telephone (919) 733-2164.

Every effort will be made to assist the student with tuition and living expenses within the framework of school policies which may be in effect at the time. However, as funds are limited, prior indebtedness will not be given favorable consideration as part of the student's budget. A financial aid brochure and student budget for each allied health program are available, upon request, in the spring of each year. Any applicant having further questions may write to Mrs. Nell Andrews, Administrator, Financial Aid, 126 Davison Building, Box 3067, Duke University Medical Center, Durham, North Carolina 27710.

Student Health Service. Student health service, health insurance, and counseling and psychological services, fully described in an earlier portion of this bulletin, are available to all allied health students.

Athletic Events. Graduate students and those enrolled in certificate programs may purchase a book of tickets for regular season home football and basketball games. All tickets are sold on a first-come, first-served basis. The ticket office is located in Cameron Indoor Stadium.

Judicial System and Regulations. Duke University expects and requires of all its students full cooperation in developing and maintaining high standards of scholarship and conduct. Each student is subject to the rules and regulations of the University which are currently in effect or which are, from time to time, put into effect by the appropriate authorities of the University. At the same time, the individual is responsible for decisions and choices within the framework of the regulations of the community as Duke does not assume in loco parentis relationships.

Any student, in accepting admission, indicates a willingness to subscribe to and be governed by these rules and regulations and acknowledges the right of the University to take such disciplinary action, including suspension or expulsion, for failure to abide by these regulations or for other conduct adjudged unsatisfactory or detrimental to the University. A copy of the Allied Health Judicial System including a code of ethics, rules of conduct, and judicial procedures is provided each student.

Fees for Transcripts. Requests for transcripts of academic records should be directed to the Office of the Medical Center Registrar. A fee of three dollars, payable in advance, is charged for each copy. However, the transcript fee is waived for financially needy students who require transcripts to apply for external funding.

Student Health Fee. All regular full-time students and part-time degree candidates are required to pay a health fee that is nonrefundable after the first day of classes in the semester. The student health fee entitles the student to outpatient treatment through the Student Health Service, inpatient treatment in the Infirmary, and use of Counseling and Psychological Services. The health fee is not to be confused with the Duke Student Accident and Sickness Insurance (the premium for this insurance is minimized due to the existence of the Student

Health Services) which covers a large number of medical costs above and beyond the treatment available through the Student Health Services. The identification of a separate student health fee in no way changes the policy concerning the Student Accident and Sickness Insurance. Student Health brochures are available in the Bursar's Office and in the Student Health Service Clinic.

Student Accident and Sickness Insurance. At the beginning of each fall semester, medical and allied health students must provide proof of coverage under an accident and sickness insurance policy or purchase the Duke Student Accident and Sickness Insurance policy. This insurance policy provides protection twenty-four hours per day during the twelve-month term of the policy of each student insured. Students are covered on and off the campus, at home, while traveling between home and school, and during interim vacation periods.

Refunds

If a student withdraws, tuition is refunded according to the following schedule:

Withdrawal from Master's Programs	Refund
Before Classes begin	full amount
During first or second week	80 %
During third to fifth week	60 %
During sixth week	20 %
After sixth week	None

Withdrawal* from Certificate Programst	Refund
Before classes begin	Full amount
During first week	80 %
After first week of classes	None

*Includes involuntary withdrawal for academic reasons.

†Course fees for students in certificate programs are payable on a yearly basis.



The Master of Health Sciences in Biometry

THE BIOMETRY TRAINING PROGRAM

Program Directors: William E. Wilkinson, Ph.D. and John R. Feussner, M.D.

This training program meets an existing need at Duke University Medical Center for formalized academic training in the quantitative and methodological principles of clinical investigation. Designed primarily for Duke clinical fellows who are training for academic careers, the program offers formal courses in biostatistics, epidemiology, decision analysis, and the use of computers for processing and analyzing medical data. Students who complete a prescribed course of study in the training program are awarded a Master of Health Sciences in Biometry degree by the School of Medicine.

The Biometry Training Program is offered by the faculty of the Division of Biometry and Medical Informatics in the Department of Community and Family Medicine with the participation of other members of the Medical Center faculty having expertise in relevant areas.

Degree and Nondegree Admission. All persons wishing to take courses in the Biometry Training Program, even on a nondegree basis, must be admitted to the program or be currently enrolled in a graduate degree-granting program at Duke. A bachelor's degree (or the equivalent) from an accredited institution is a prerequisite for admission either as a degree candidate or as a nondegree student.

A student seeking admission to the Biometry Training Program should obtain an application packet which contains the necessary forms and detailed instructions on how to apply. Requests for application forms or for additional information about the training program should be directed to the Biometry Training Program, Box 2914, Duke University Medical Center, Durham, North Carolina 27710, (919) 286-8220.

A complete application for nondegree admission requires only the application form and an official transcript from each postsecondary institution attended. Applicants with an M.D., Ph.D. or equivalent degree who are currently medical residents, fellows or faculty members at Duke are not required to submit transcripts for nondegree admission.

A complete application for admission as a degree candidate consists of the application form and the following supporting documents: (1) an official transcript from each postsecondary institution attended; (2) three letters of evaluation written by persons qualified to testify to the applicant's capacity for graduate work; (3) official scores on the Graduate Record Examination General (Aptitude) Test. (GRE scores are not required for applicants having an M.D., Ph.D. or equivalent degree.)

In the event that a nondegree student is subsequently admitted as a degree candidate, relevant course work will be accepted for degree credit.

Program of Study. The degree requires 24 units of graded course work and a research and thesis project for which six units of credit are given. The formal course work consists of a sequence of eight integrated courses required of all degree candidates: BTP-211, 212, 213, 215, 216, 218, 219 and 220 (see Courses of Instruction below). The student's clinical research activities provide the setting and the data for the project; the thesis serves to demonstrate the student's competence in the use of quantitative methods in medical research.

The program is designed for part-time study, allowing the fellow/student to integrate the program's academic program with his or her clinical training. The ten-month academic year consists of three terms: a sixteen-week fall term, a twelve-week spring term beginning in January and a twelve-week summer term beginning around 15 April. (The exact dates are determined by the Medical School's calendar for third and fourth year medical students.) A student taking one course each term can complete the required course work in the fall term of the third year, leaving the remainder of the third year for completion of the research project.

Examining Committee. The faculty member who directs the student's research project and two other faculty members constitute an examining committee to certify that the student has successfully completed this degree requirement. The chairperson and at least one other member of this committee must have an appointment in the Division of Biometry and Medical Informatics; the constitution of each examining committee must be approved by the program directors.

Grades. Grades in the Biometry Training Program consist of *H* (High Pass), *P* (Pass), *L* (Low Pass) and *F* (Failing). In addition, an *I* (Incomplete) indicates that some portion of the student's work is lacking, for a reason acceptable to the instructor, at the time grades are reported. The instructor who gives an Incomplete for a course may specify a date by which the student must make up the deficiency; this date will generally be no later than the last day of class of the subsequent term. If an Incomplete is not resolved within one calendar year from the date the course ended, the grade of *I* becomes permanent and may not be removed from the student's record.

A student's enrollment as a degree candidate will be terminated if he or she receives a single grade of *F* or two grades of *L* in the required courses. For these purposes, *WF* (see below) and a permanent *I* will both be considered failing grades.

Withdrawal from a Course. During the drop/add period (the week in which classes begin and the preceding week), a course may be dropped at the student's discretion and no grade will be recorded. (A full tuition refund is granted only for withdrawal before the beginning of classes.) If a course is dropped after the week in which classes begin, permission of the instructor and the program director are both required. The status of the student at the time of withdrawal from the course will be determined and indicated on the permanent record as *WP* (Withdrew Passing) or *WF* (Withdrew Failing).

Tuition. Tuition for the 1993-94 academic year is \$375 per unit. (Tuition refunds are governed by the Duke University policies which are described elsewhere in this bulletin.) Faculty members and some fellows may be eligible for the university's Educational Assistance Program. Other sources of support exist in some clinical departments; prospective students should consult with program directors and division chiefs regarding potential funding sources.

Transfer of Credit. Transfer of credit for graduate work completed at another institution will be considered only after a student has earned a minimum of 12 units in the Biometry Training Program. A maximum of 6 units of credit may be transferred for graduate courses completed at other institutions. Such units will be transferred only if the student received a grade of *B* (or its equivalent) or better. The transfer of graduate credit does not reduce the required minimum registration of 30 units for the degree. However, a student who is granted such transfer of credit may be permitted to register for as much as 12 units of thesis research instead of the usual 6 units.

Courses of Instruction

BTP-211. Probability and Statistical Inference. Laws of probability, probability distributions, descriptive statistics, graphical displays of relationships, philosophy of statistical tests, tests for differences in central tendency, paired comparisons, and correlation. Parametric and nonparametric procedures. Simple linear regression and one way analysis of variance. Type I and Type II errors and problems of multiple comparisons. 4 units.

BTP-212. Design of Etiological, Clinical and Experimental Studies. General principles and issues of study design. Observational studies, including descriptive (correlational, case report, cross-sectional) studies, cohort and case-control designs, their relative advantages, and statistical methods used in their analysis. Classical designs (parallel group, randomized block, and cross-over) will be surveyed. Introduction to controlled clinical trials

and to sequential design strategies. Ethical considerations will be discussed. Prerequisite: BTP 211. 3 units.

BTP-213. Research Data Management and Statistical Computing. Database management theory and techniques, including methods for the collection, entry, storage and retrieval of research data. Statistical computing algorithms and techniques, primarily using SAS. Prerequisites: BTP-211 and experience with PC-DOS (e.g., Continuing Education short course) or permission of instructor. 3 units.

BTP-215. Regression Models. Formulation of linear regression models and definition of model parameters in the context of multivariable regression, analysis of variance, and analysis of covariance. Techniques for graphically checking model assumptions and testing lack of fit. Model validation, the effect of modeling too many variables and methods for reducing the number of variables to model. Introduction to the logistic and Cox proportional hazards regression models. Prerequisites: BTP-211 and 213. 4 units.

BTP-216. Survival and Risk Analysis. General aspects of survival analysis, including failure-time distributions, hazard functions, and Kaplan-Meier estimation of survival functions. Theory and practical analytic strategies for logistic and Cox regression models of survival and risk data. Regression models for analysis of matched case-control data. Laboratory exercises involving analysis of clinical and epidemiologic follow-up data. Prerequisites: BTP 215 and 219. 3 units.

BTP-217. Clinical Decision Analysis. Using formal methods for analyzing complex patient management problems. Structuring problems as trees. Applying data from the literature to estimate the likelihood of outcomes. Quantitating the value of health outcomes. Calculating the strength of preference for one strategy over others. Decision analysis as a guide to clinical research and as a policy tool. Prerequisite: BTP-211 or permission of instructor. 3 units.

BTP-218. Clinical Trials. Fundamental concepts in the design and analysis of clinical trials. Topics include sample size calculation, determination of study duration, randomization procedures, study monitoring and early termination, multiple endpoints, protocol evaluation, and data management. Published accounts of clinical trials will be used to illustrate concepts. Prerequisites: BTP-212 and 216. 2 units.

BTP-219. Categorical Data Analysis. Methods for analyzing nominal and ordinal response variables including chi-square tests of independence and homogeneity, Mantel-Haenszel tests, logistic regression models, and weighted least squares fitting of linear models. Measures of association such as Kendall's tau, Spearman's rho, the relative risk, and the odds ratio. Prerequisite: BTP-215. 3 units.

BTP-220. Communicating and Critiquing Statistical Methods in Medical Research. Fundamentals of scientific and statistical communication, including organization of scientific papers using statistics, are illustrated through writing and critiquing articles applying linear and logistic regression, categorical data analysis, survival analysis and other techniques. Grant preparation and grantsmanship. Prerequisites: BTP-218 and 219. 2 units.

BTP-221. Statistical Methods in Human Genetics. Introduction to statistical procedures for investigation of the inheritance of human characteristics through studies of families and populations. Mutation, selection, equilibrium conditions, estimation of genetic parameters, and testing of genetic hypotheses; monogenic, oligogenic, polygenic, and "mixed" inheritance models, including X-linked models. Segregation analysis, including methods for the evaluation of major genetic effects, age of onset, and ascertainment. Robust and likelihood-based approaches to linkage analysis. Methods in genetic epidemiology. Prerequisite: BTP-211. 3 units.

The Physician Assistant Program

MASTER OF HEALTH SCIENCES CURRICULUM

Physician Assistant Program Core Faculty

Program Director: Reginald D. Carter, Ph.D., PA
Medical Director: Joyce A. Copeland, M.D.
Associate Program Director: Patricia M. Dieter, PA-C, MPA
Director of Clinical Education: Philip A. Price, PA-C, M.H.S.
Director of Preclinical Education: J. Victoria Scott, PA-C, M.H.S.
Director of Recruitment and Minority Affairs: Lovest T. Alexander, PA-C, M.H.S.
Pediatrics Coordinator: Mary K. Austin, PA-C, M.P.H.
Surgical Coordinator: Paul C. Hendrix, PA-C, M.H.S.
Clinical Medicine Coordinator: Valerie S. Forbes, PA-C

The physician assistant (PA) concept originated at Duke over two decades ago. Dr. Eugene A. Stead Jr., then chairman of the Department of Medicine, believed that midlevel practitioners could increase consumer access to health services by extending the time and skills of the physician. Today, physician assistants are well-recognized and highly sought-after members of the health care team who, working interdependently with physicians, provide diagnostic and therapeutic patient care in virtually all medical specialties and settings. They take patient histories, perform physical examinations, order laboratory and diagnostic studies, and develop patient treatment plans. In many states, including North Carolina, PAs have the authority to write prescriptions. Their job descriptions are as diverse as those of their supervising physicians, and may also include patient education, medical education, health administration and research.

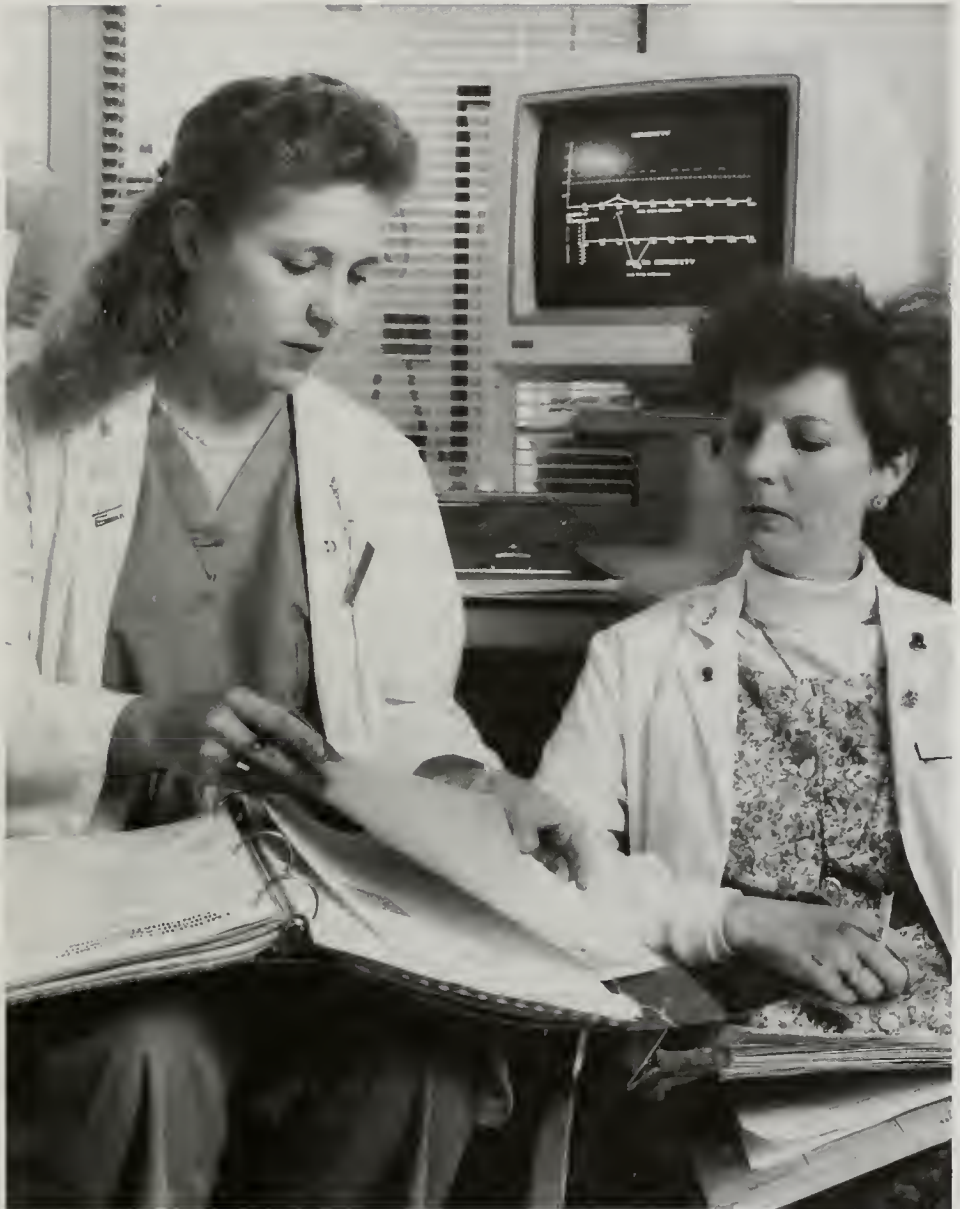
The role of the graduate PA has evolved substantially over the past twenty-five years. While the majority of PAs in clinical practice continue to provide primary care services, the percentage serving in solo practice or private group settings has declined while the percentage practicing in institutional settings has risen. Today, over half of all graduate PAs are employed in large clinics, hospitals and institutional settings. There are also more nonclinical positions developing for PAs; while these positions do not involve patient care, they depend on a strong clinical knowledge base (e.g., drug study coordinator, clinical services coordinator, etc.).

In recognition of the increased responsibilities and expanded roles of PAs, the increased number of applicants with college degrees, and the quality of the PA educational program, the university decided to begin offering the Master of Health Sciences (M.H.S.) degree to students entering the program in the fall of 1990. The M.H.S. curriculum is designed to provide PAs a greater depth of knowledge in the basic medical sciences and clinical medicine, as well as skills in administration and research. With these expanded skills, graduates can take advantage of the wide diversity of positions available to PAs.

Program of Study. The curriculum is twenty-five consecutive months in duration and is designed to provide an understanding of the rationale for skills used in patient assessment, diagnosis, and management. The first twelve months of the program are devoted to preclinical studies in the basic medical and behavioral sciences, and the remaining thirteen months to clinical experiences in primary care, medical and surgical specialties, and research study.

The preclinical curriculum is integrated in such a way as to introduce the student to medical sciences as they relate to specific organ systems and clinical problems. Learning strategies include the traditional lecture format and basic science laboratory, small group tutorials, and computer-assisted diagnostics using simulated patients. Regular patient contact is an important part of the first year curriculum. Students begin to see patients during the spring semester as part of the Patient Assessment course; this patient contact continues throughout the summer term of the first year.

As part of the clinical practicum, students are required to take rotations in inpatient medicine, surgery, emergency services, outpatient medicine, pediatrics, obstetrics/gynecology, and behavioral medicine. In addition to these rotations, three elective clinical rotations



are included in the clinical year schedule, as is a four-week period devoted to work with a Medical Center faculty advisor toward the completion of a research paper. The final four weeks of the clinical year are spent in a specialty of the student's choosing; this final preceptorship often serves as a bridge to employment as a practicing PA.

Because the clinical teaching is carried out in many practice settings throughout North Carolina and the Southeast, students should plan on being able to travel away from the Durham area for part of their clinical experience.

Curriculum. Before proceeding into the clinical phase of the curriculum, students must satisfactorily complete the following:

Preclinical Year

Fall Semester

PAP-200. Basic Medical Sciences	5 credits
PAP-205. Anatomy	4 credits
PAP-210. Laboratory Medicine	4 credits
PAP-215. Physical Diagnosis	3 credits
PAP-220. Clinical Medicine I	4 credits
	<u>20 credits</u>

Spring Semester

PAP-211. Laboratory Medicine II	1 credit
PAP-221. Clinical Medicine II	9 credits
PAP-230. Fundamentals of Surgery	5 credits
PAP-235. Patient Assessment I	2 credits
PAP-240. Behavioral Aspects of Medicine	2 credits
	<u>19 credits</u>

Summer Term

PAP-222. Clinical Medicine III	7 credits
PAP-236. Patient Assessment II	1 credit
PAP-245. Perspectives on Health	2 credits
PAP-250. Health Systems Organization	2 credits
PAP-255. Introduction to Research and Epidemiologic Principles	3 credits
	<u>15 credits</u>

Clinical Year

Following successful completion of the preclinical courses, students enter the clinical phase of the program, completing the following experiences:

PAP-300. Outpatient Medicine	4 credits
PAP-305. Research Paper	3 credits
PAP-310. Behavioral Medicine	4 credits
PAP-320. Inpatient Medicine	8 credits
PAP-340. General Surgery	4 credits
PAP-350. Emergency/Outpatient Surgical Service	4 credits
PAP-360. Pediatrics	4 credits
PAP-370. Obstetrics/Gynecology	4 credits
Elective	4 credits
Elective	4 credits
Elective	4 credits
PAP-390. Preceptorship	4 credits
	<u>51 credits</u>

The student receives four credits for rotations which are four weeks in length, and eight credits for rotations which are eight weeks in length.

In addition to successful completion of the preclinical and clinical phases of the program, the PA student must also complete a master's paper. A four-week research (independent study) period will be allotted within the clinical training period for the student to complete the final master's paper.

Program Policies and Grading Standards. Grades for all courses and clinical rotations within the Physician Assistant curriculum will be assigned on the basis of the following: honors (H), pass (P), low pass (L), and fail (F). The Physician Assistant Program is designed to integrate classroom and clinical learning experiences considered necessary for competency

as health care providers. Therefore, the failure of any required course will prevent a student from continuing in the program. Also, a student can receive no more than a total of four grades of "low pass" in the 27 required courses during the clinical and preclinical phases of the program.

A grade of "incomplete" (*I*) may remain on a student's transcript for one year only. After one year, a grade of "incomplete" will automatically be converted to an *F* (fail). An extension to this one year limit may be granted by the program director; this request must be submitted in writing to the program director no later than 30 days prior to the expiration of the one year time limit.

Students in the Physician Assistant Program are participants in a professional training program whose graduates assume positions of high responsibility as providers of health care. Accordingly, students are evaluated not only on their academic and clinical skills but also on their interpersonal skills, reliability, appearance and professional conduct. Deficiencies in any of these areas will be brought to the student's attention in the form of a written evaluation and may result in probation, suspension or expulsion from the program.

Attendance and Excused Absences. Students are expected to attend all lectures, laboratories and seminars. Absences are excused only for illness or personal emergency, and students are expected to notify program faculty in advance of an expected absence.

Prerequisites for Admission. The prerequisites for admission to the M.H.S. physician assistant curriculum include:

1. A baccalaureate degree from an accredited institution. College seniors are eligible to apply, provided they will receive the baccalaureate degree prior to the August starting date for the PA Program. Those candidates who received their baccalaureate degrees from colleges and institutions outside of the United States must complete at least one year (30 semester credits) of additional undergraduate or graduate study at a U.S. college or university prior to application to the program.
2. Preparatory science courses, including at least 11 semester hours in the biological sciences and 8 semester hours in chemistry. Preference will be given to candidates who have completed courses in anatomy, physiology, microbiology, and statistics. Applicants from all academic disciplines are welcome, provided they meet the preparatory science course prerequisites.
3. Scores of the Graduate Record Examination (GRE general test), taken within the last five years.
4. A minimum of six months of health care experience, preferably with direct "hands-on" patient contact. Preference is given to those candidates whose health care experience has been paid, full-time employment.

Application Procedures. Application materials are mailed to prospective applicants from 1 June through 15 December each year, and may be obtained by writing: Admissions Coordinator, Physician Assistant Program, PO Box CFM 2914, Duke University Medical Center, Durham, NC 27710, telephone: (919) 286-8234. Applications are accepted by the university no earlier than 1 August and no later than 30 December for the new class which enters in August each year. Applications must contain:

1. A completed official application form, including a nonrefundable fee of \$35.
2. Official transcripts from all colleges/universities and other postsecondary institutions attended.
3. Scores of the Graduate Record Examination (GRE). Applicants should take the GRE in October or earlier.
4. Three letters of recommendation, to include one from a health care provider with whom the applicant has worked.

Selection Factors. The program has a specific interest in enrolling students from diverse social, ethnic, and educational backgrounds. Emphasis is placed upon personal maturity, quality of health care experience, dedication to the health field, and academic potential. Information submitted by each applicant is carefully reviewed by the Committee on Admissions, and selected applicants are invited to Duke University for personal interviews. These interviews take place from January through early March; 40 students are chosen from among those interviewed. **Only full-time students will be admitted.**

Candidates are notified of the admissions committee's decision as soon as possible after the interview, and no later than 1 April. Those candidates who have been accepted are asked to respond in writing with their decision and to confirm their place in the class by submitting the nonrefundable registration and deposit fees by 1 May. Each year, an alternate list is selected; a variable number of candidates from this list are offered a position in the class.

Tuition and Fees.* On notification of acceptance, prospective PA students are required to pay a nonrefundable first registration fee of \$35, as well as a nonrefundable program deposit of \$175. For those who do matriculate, the program deposit is applied to the cost of tuition.

Estimated expenses for the 1993 entering class of the Master of Health Sciences Physician Assistant Program are:

Tuition	\$260/credit (average annual tuition \$13,600 per year)
Books, uniforms, and instruments	\$1,525
Food	\$277 per month
First Year Fee (laboratory, etc.)	\$750
Lodging	\$345 per month
Student Health Fee	\$178 per semester
Student Accident and	\$545 per year—single
Sickness Insurance	\$1,761 per year—family
Miscellaneous (travel, clothing, etc.)	\$299 per month

*These are estimated figures only. Tuition and fees are subject to change without notice.

Financial Aid. Qualified students may be eligible for government sponsored loans up to \$8,500. In addition, funds are available from the program's institutional loan fund. A limited amount of scholarship funds will also be available for 1993-94. All financial aid awards are made on the basis of documented financial need. Financial aid application packets are distributed on the admissions interview date.

The U. S. Public Health Service has several programs which offer scholarships, stipends and loan repayment to PA students who commit to varying periods of employment within USPHS facilities. Interested applicants can call either the PA program or the NHSC program directly at (301) 443-1650 for further information.

Applicants are encouraged to request information and application forms from clubs, organizations, foundations and agencies as soon as possible after applying for admission to the program. Many libraries have information on sources of financial aid. Also, the financial aid offices at nearby colleges and universities often have information on sources of funding.

With the program director's approval, first-year students may be employed up to twenty hours per week. **Because of the demands of the clinical year, it is difficult or impossible for the second-year student to work.**

More detailed information regarding financial aid can be obtained from: Office of Financial Aid, Box 3067, Duke University Medical Center, Durham, NC 27710.

Commencement. Students in the M.H.S. Physician Assistant Program who have completed required courses and rotations as scheduled, as well as the master's paper, will receive the M.H.S. degree at university commencement held in May; however, the student must continue on in the program, completing the remainder of the clinical rotations and the

preceptorship, through August of the same year. The Physician Assistant Program certificate is awarded at that time.

Courses of Instruction

Course credits are the recognized units for academic work in the PA Program. All courses are required and no transfer credit is accepted.

Preclinical Year Courses

PAP-200. Basic Medical Sciences. The basic facts, concepts and principles that are essential in understanding the fundamental mechanisms of human physiology, pathology, pharmacology and nutrition. This course presents the basic methods of clinical problem solving, and serves as a prerequisite to the clinical medicine course by emphasizing the underlying principles of the etiology, management and prevention of disease processes. 5 credits. *Carter*

PAP-205. Anatomy. Functional and applied anatomy as it relates to physical diagnosis and common clinical findings. Cadaver prosections, lectures, and audiovisual materials are used in the anatomy component of the course. 4 credits. *Hendrix*

PAP-210, 211. Laboratory Medicine I, II. An introduction to the performance and interpretation of routine hematologic, urinary, microbiologic, and other laboratory procedures commonly used in practice. This course is taught by faculty/staff from the Department of Pathology, Medical Technology Program and the Hospital Laboratories. 5 credits. *Schmidt*

PAP-215. Physical Diagnosis. An introduction to the techniques for performing and recording the physical examination. Taught in small-group format; lectures and audiovisuals are used, as well as extensive small group practice sessions. Six weeks of orthopaedic physical diagnosis are included in this course. 3 credits. *Price*

PAP-220, 221, 222. Clinical Medicine I, II, III. The diagnosis and management of the most common clinical problems seen by primary care practitioners. Using an organ systems approach, clinical information is presented in conjunction with appropriate correlative lectures and labs in anatomy, physiology, pharmacology, pathology, radiology and nutrition. This is a core course around which most other courses are organized. 20 credits. *Scott*

PAP-230. Fundamentals of Surgery. The basic surgical concepts needed for the PA to function in primary care settings as well as major surgical areas. The course emphasizes surgical technique and emergency procedures, as well as asepsis, minor procedures and anesthesia. The animal surgery laboratory is an essential component of this course. 5 credits. *Hendrix*

PAP-235, 236. Patient Assessment I, II. An introduction to medical interviewing and the recording and presentation of clinical information. Teaching methods include lectures, small groups and role playing. For the first eight weeks of the course, students concentrate primarily on history-taking, and are assigned by their small-group instructors to interview patients on the wards. During the second eight weeks of the Spring Semester, and during the Summer Term, students are assigned in small groups to fellows from the Department of Medicine. Weekly, each student is assigned to a hospitalized patient to perform a complete history and physical examination. 3 credits. *Dieter*

PAP-240. Behavioral Aspects of Medicine. An introduction to the skills, knowledge and sensitivity needed to communicate and intervene effectively in a wide variety of psychosocial situations. 2 credits. *Kertesz*

PAP-245. Perspectives on Health. A professional issues review. This course emphasizes current issues facing the profession, including legal and ethical problems, and the unique place of PAs within the health care system. 2 credits. *Scott*

PAP-250. Health Systems Organization. An introduction to the structure and administrative principles in use in health care organizations. A lecture series taught by an interdisciplinary faculty and by community experts in health care organization. Topics include the patient as consumer, third-party payment, public policy trends and organizational behavior. 2 credits. *Warren*

PAP-255. Introduction to Research and Epidemiologic Principles. Foundations of research methodology related to the study of disease distribution and issues in study design, data collection and methods of analysis. The PA student will, under the guidance of a medical center faculty advisor, begin work on the final master's paper by developing a literature review and protocol during this course. 3 credits. *Broadhead*

Clinical Year Courses

COMMUNITY AND FAMILY MEDICINE

PAP-300. Outpatient Medicine. This rotation emphasizes the outpatient evaluation and treatment of conditions common at the family medicine/primary care level, and the appropriate health maintenance measures for different age groups. 4 credits. *Staff*

PAP-305. Master's Paper. During a four-week research period during the clinical year, the student draws to a conclusion his/her work on the master's paper. Final approval of this document is determined by the student's faculty advisor, who also assigns the master's paper grade. 3 credits. *Broadhead*

PAP-310. Behavioral Medicine. The student is assigned to a psychiatric and/or behavioral clinical setting, either inpatient or outpatient. This rotation facilitates the acquisition of communication and behavioral modification skills which will be useful in the primary care setting. 4 credits. *Staff*

MEDICINE

PAP-320. Inpatient Medicine. During this rotation, the student learns to apply basic medical knowledge to the problems and situations encountered on an inpatient service. By collecting a data base, formulating a complete problem list, and participating in daily rounds and in the management of patient problems, the student develops an awareness of the complexity of disease processes and differential diagnosis. 8 credits. *Staff*

OBSTETRICS/GYNECOLOGY

PAP-370. Obstetrics/Gynecology. The student learns about common gynecological problems, pregnancy and delivery. Assisting at the operating table may be a significant aspect of the rotation. The rotation emphasizes clinical experience with cancer detection techniques, abnormal menstruation and bleeding, infections and contraception counseling. *Staff*

PEDIATRICS

PAP-360. Pediatrics. In this rotation, the student is assigned to either an institutional setting or a community-based pediatric site. Special emphasis is placed on communication skills and relating sensitively to both children and parents. The student gains familiarity with normal growth and development, pediatric preventive medicine, and evaluation and management of common childhood illnesses. *Staff*

SURGERY

PAP-340. General Surgery. The student is assigned by the chief resident to one of the surgical teams. This rotation emphasizes preoperative evaluation and preparatory procedures, assisting at the operating table, and management of patients through the postoperative period to discharge. 4 credits. *Staff*

PAP-350. Emergency/Outpatient Surgical Service. This rotation stresses the evaluation and management of surgical problems of the ambulatory patient. In the emergency room, the student gains experience in the initial evaluation of potential surgical conditions, and performing

problem-specific examinations and minor surgical skills. There is also the opportunity to followup patients on return visits. 4 credits. *Staff*

In addition to the above required core rotations, each student is required to complete three electives, that can be chosen from among the following:

COMMUNITY AND FAMILY MEDICINE

PAP-301. Occupational Medicine

PAP-302. Geriatrics

MEDICINE

PAP-321. Cardiology

PAP-322. Dermatology

PAP-323. Endocrinology

PAP-324. Emergency Medicine

PAP-325. Hematology/Oncology

PAP-326. Hyperbaric Medicine

PAP-327. Infectious Diseases

PAP-331. Nephrology

PAP-332. Neurology

PAP-333. Pulmonary Medicine

PAP-334. Rheumatology

PAP-335. AIDS Clinical Trials Unit

PAP-336. Medical ICU

PAP-337. Coronary Care Unit

OPHTHALMOLOGY

PAP-381. Ophthalmology

PEDIATRICS

PAP-361. Pediatric Cardiology

PAP-362. Pediatric Surgery/Cardiothoracic Surgery

PAP-363. Pediatric Hematology/Oncology

PAP-364. Pediatric Allergy/Respiratory

PAP-365. Pediatric Endocrinology

PAP-366. Pediatric Infectious Disease

PAP-367. Intensive Care Nursery

SURGERY

PAP-341. Cardiothoracic Surgery

PAP-342. Otolaryngology

PAP-343. Neurosurgery

PAP-344. Orthopedics

PAP-345. Plastic Surgery

PAP-346. Sports Medicine

PAP-347. Urology

PAP-351. Emergency Medicine

PAP-352. Trauma

PAP-353. Adult Surgical ICU

Each of these electives is 4 credits. In addition to the electives listed above, a limited number of independent studies, in which students construct their own need-specific learning experiences, may be arranged with the approval of the clinical education director. More detailed information on the elective and independent study rotations may be obtained from the director of clinical education of the Physician Assistant Program.

The final rotation in the PA Program, immediately prior to September graduation, is the Preceptorship (PAP-390-4 credits). This required rotation must be completed by all students. Students are encouraged to select a preceptor in the area of their anticipated employment and, during this period of time, to explore the tasks and team aspects of functioning as a midlevel practitioner.

Transfusion Medicine Program

Transfusion Medicine Program Core Faculty

Professor, Department of Pathology and Director of Clinical Laboratories: Salvatore Pizzo, M.D., Ph.D., *Chairman*

Assistant Professor: Peter Issitt, Ph.D., *Program Director*

Education Coordinators: Patty Hanneman, M.Ed., MT(ASCP)SBB; Cynthia L. Wells, Ed.D., MT(ASCP), CLS(NCA)

Professor: Wendell Rosse, M.D.

Assistant Professor: Steven Bredehoeft, M.D., *Medical Director*

Associate Professors: Emily G. Reisner, Ph.D.; Marilyn Telen, M.D.; Frances K. Widmann, M.D.

Assistant Professor: Deborah Dawson, Ph.D.

Associate: Margaret C. Schmidt, Ed.D., MT(ASCP)SH, CLSPH(NCA)

Clinical Teaching Staff: Linda Issitt, MT(ASCP)SBB

Program of Study. This program, beginning in August of each year, is an intensive study of transfusion medicine and advanced blood banking technology. The curriculum is designed to provide indepth knowledge and experience in administration, supervision, teaching, technical consultation, and research. With these expanded skills the graduate can take advantage of a wide variety of career opportunities available in hospital blood banks and transfusion services, independent blood centers, research and development laboratories, commercial sales and marketing, and educational institutions.

SBB Certification. This program is accredited by the Committee on Allied Health Education and Accreditation (CAHEA) of the American Medical Association in association with the American Association of Blood Banks. Students are eligible to sit for the Specialist in Blood Bank Technology examination given by the American Society of Clinical Pathologists after completion of the first year.

Degree Requirements. Forty-four units of graduate credit constitutes minimum enrollment for the M.H.S. degree. Of these, at least twenty-four must be in transfusion medicine. Seven units of biometry credits must be completed. A minimum of seven units must be completed from choices in related fields that have been approved by the program director. The remaining six units are earned by the submission of an approved thesis. All students must successfully complete an oral examination before conferral of the degree.

Thesis Requirements. The thesis should demonstrate the student's ability to collect, arrange, and report pertinent material on a clinical or research problem. Requirements of form are set forth in the *Transfusion Medicine Guide for the Preparation of Theses*, copies of which are available from the program director and education coordinator. To receive a May degree, the thesis and examination must be completed before 15 April for a May degree, and at least one week before the final day of the second summer term for a September degree, and one week before the final day of the fall semester for a December degree.

The Examining Committee and Examination. An examining committee composed of three faculty members will conduct an examination and certify the student's success or failure. Committee members must sign all copies of the thesis.

Grading Policies. Grades for all courses will be assigned on the following basis: high pass (H), pass (P), low pass (L), and incomplete (I). Failure (F) in any course will prevent a student from continuing in the program. The instructor may approve the awarding of an "I" for a course based on a mutually agreed upon schedule for completion of the work. The period of time for completion of the work may be no longer than six months. An "I" will convert to an "F" if the coursework is not completed by the deadline established by the instructor.

CURRICULUM

Year 1

	<i>Course Units</i>
TM-200 Basic Sciences	1.0
TM-210 Transfusion Medicine	2.0
TM-220 Blood Group Systems	2.0
TM-230 Immunology	2.0
TM-240 Seminar/Journal Club/Writing	1.5
TM-250 Education	2.0
TM-260 Management and Supervision	2.0
TM-270 Research	2.5
TM-280 Clinical Practicum	8.0
	<hr/> total 23.0

Year 2

BMI-211 Probability and Statistical Inference	4.0
BMI-212 Design of Studies	3.0
TM-371 Thesis Research	6.0
TM-390 Management Practicum	1.0
Electives from established university courses	7.0
	<hr/> total 21.0

Prerequisites for Admission. The prerequisites for admission to this M.H.S. curriculum include:

1. a baccalaureate degree in one of the sciences from an accredited institution or
2. a baccalaureate degree in a non-science major and documented laboratory experience in a scientific setting; and
3. scores of the Graduate Record Examination (GRE general test), taken within the last five years.

Candidates who received their baccalaureate degrees from colleges and universities outside the United States must submit a transcript evaluation showing degree equivalency and subject matter breakdown.

Application Procedures. Application materials are mailed to prospective applicants upon request to Admissions Coordinator, Transfusion Medicine Master's Program, Box 2929, Duke University Medical Center, Durham, NC 27710, telephone 919/684-6015. Applications will be accepted between September 1 and December 31 of the year preceding matriculation. After December 31st, applications will be accepted on a space-available basis.

The application must include:

1. a completed official Duke University application form and a nonrefundable application fee of \$35;
2. if certified, a notarized copy of the certificate from the certifying agency;
3. official transcripts from all colleges, universities, and professional schools attended;
4. GRE scores (examinations should be taken no later than December);
5. three letters of recommendation including at least two from employers; and
6. a personal interview with members of the Admissions Committee, if requested, after the review of the completed application file.

Candidates will be notified of the admissions committee's decision as soon as possible after the interview but no later than 1 April. Accepted candidates will be required to submit a nonrefundable deposit of \$225 to hold their places in the class. This deposit applies to the tuition fee.

Tuition and Fees*:

Year 1

Tuition	\$10,500
Books	400
Lab coats	120
Laboratory fees	200
Manual fee	200
Hepatitis vaccine	124
Student health fee (\$178 per semester)	534
Student accident and health insurance	(single) 545 (family) 1,761
Vehicle registration	50
Lodging/utilities	3,604
Food	3,025
Miscellaneous (travel, clothing, etc.)	3,059
SBB examination fee	125
	<hr/> total \$22,486

Year 2

Tuition	\$10,500
Books	300
Manual fee	100
Research fee	500
Student health fee (\$178 per semester)	534
Student accident and health insurance	(single) 545 (family) 1,761
Vehicle registration	50
Lodging/utilities	3,604
Food	3,025
Miscellaneous (travel, clothing, etc.)	3,059
	<hr/> total \$22,217

*These are estimated figures only. Tuition and fees are subject to change.

Financial Aid. Please refer to the Medical Center Bulletin section on student aid in the chapter, "The Allied Health Programs." More detailed information is available from the Office of Financial Aid, School of Medicine, Box 3067, Duke University Medical Center, Durham, NC 27710. Based on individual qualifications, students may be eligible for part-time positions in the Clinical Laboratory Services of Duke Hospital.

Transportation Requirements. The use of facilities other than Duke Hospital requires transportation. It is the responsibility of each student to provide a means of transportation to and from facilities selected for learning experiences.

Course Descriptions

TM-200. Basic Sciences. An introduction to sciences of paramount importance to transfusion medicine; covers principles and applications of statistics, biochemistry, and molecular biology; statistics portion deals with experimental design and interpretations of results; biochemistry and molecular biology portions use examples from the human blood groups to illustrate the role of basic science in normal and pathological immune reactions; correlations of biochemical structure and cell function will be described. 1 credit. *Dawson, Telen, and Rosse*

TM-210. Transfusion Medicine. Describes human genetics, hematopathology, coagulopathies, the use of blood products and infectious diseases as they relate to transfusion medicine; genetics portion covers transmission genetics and inheritance patterns of the human blood groups; hematopathology and coagulopathies describe abnormal cell produc-

tion and abnormal coagulation; use of blood products details correct preparation of blood components, calculation of doses and mechanisms by which the components correct clinical abnormalities; various viruses, bacteria and parasites that can be transmitted by transfusion will be discussed together with the multitude of selection and testing methods used to ensure exclusion of potentially infectious units of blood. 2 credits. *Bredehoeft, Reisner, Rosse, and Schmidt*

TM-220. Blood Group Systems. Presents human red cell and leukocyte systems from historical, genetic, immunological, serological, and biochemical perspectives; describes how unusual deletion or suppressor genes can affect phenotype and how phenotypes can be used to recognize haplotypes; more than 600 red cell and 70 leucocyte antigens, and the antibodies that define them are presented; biochemical structure of antigens is described together with the nature of the immune responses against them; presents methods used to differentiate between clinically significant and insignificant antibodies. 2 credits. *P. Issitt and Reisner*

TM-230. Immunology. Principles of the immune response in man to include the humoral and cellular arms; to cover the structure and function of cells of the immune system; antigen processing; primary and secondary immune responses; the genetic control of the immune response; immunologic memory; utilization of effector mechanisms by the immune system and the results of allo- and auto-immunization. Correlations of immune responsiveness with human disease states and the effects of production of alloimmune and autoimmune antibodies in transfusion therapy. 2 credits. *Widmann*

TM-240. Seminar/Journal Club/Writing. By faculty-critiqued student reviews of published scientific papers in seminars and journal club, the student will be taught how to evaluate data in the literature. Emphasis will be placed on planning experiments, selecting the most appropriate methods, analyzing the results to determine statistical significance, and interpreting the data for the most likely and other non-excluded explanations; honing of library research skills and exercises requiring practice and revision of expository writing are included. Appropriate use of primary references and the dangers of secondary referencing will be described. 1 1/2 credits. *P. Issitt and Reisner*

TM-250. Education. This course will explain the fundamentals and principles of planning and implementing an educational program. The need for establishing course goals and objectives and the means of ensuring, at the planning stage, that each will be met during the actual teaching, will be emphasized. Various mechanisms for course evaluation will be taught so that students will be able to determine the success of the program in attaining goals and objectives. Teaching in the clinical setting will be emphasized and each student will complete a supervised project. 2 credits. *Wells*

TM-260. Management and Supervision. This course will be presented by Business School faculty and Medical Center faculty and staff to prepare the laboratory medicine practitioner to manage operational and fiscal laboratory affairs. Principles and techniques of budgeting, staffing, leasing, negotiating, and supervising will be presented in lecture and participatory exercise formats. Course will prepare students for TM-390. 2 credits. *Business School faculty and Medical Center faculty/staff*

TM-270. Research. Supervised research in selected topics related to genetics, biochemistry, serology, molecular biology, or immunology of the human red cell or leucocyte blood groups; projects are to be co-developed between faculty mentor and the student in order to demonstrate how complete research protocols are established with appropriate controls to anticipate any set of results before actual practical work begins; planned projects are to be short-term with at least the potential for completion within the first year; however, projects may be designed as a potential starting point for TM-371 Thesis research. 2 1/2 credits. *P. Issitt and Reisner*

TM-280. Clinical Practicum. Supervised clinical rotations in compatibility testing, immuno-hematology, parentage testing, molecular biology, donor selection and processing, and the preparation, storage, and shipment of blood products, quality assurance, and record keeping; emphasis is placed on the most effective functioning and direction (supervision) of the laboratory or division, and resolution of both repetitive and unusual problems which will vary by department. At the end of each rotation, the student will be capable of directing the laboratory area in a manner ensuring maximal safety and efficacy of patient care. 8 credits. *Staff*

TM-371. Thesis Research. Design of a project that may deal with a scientific, technical, managerial, or educational topic concerning transfusion medicine; initial planning phase is to be under the direction of a faculty member. As the project develops and data accumulate, the student will be encouraged to work independently, to finish the research and to write a thesis by the end of the course. The student will be expected to defend the thesis in an oral examination before selected faculty members, including the project mentor who will serve as chair of the examination committee. 6 credits. *Staff*

TM-390. Management Practicum. Instruction regarding the management and supervision of a large and active transfusion service; topics covered include human relations, interpersonal relationships, staffing and scheduling, operation within budgetary constraints, and compliance with all governmental regulations. The student will work with the faculty to learn how to handle and resolve personnel problems; all aspects of management and supervision will be based on the premise that the most important consideration is the provision of quality patient care. 1 credit. *L. Issitt*

Graduate School Program

The Graduate School of Duke University awards a Master of Science degree to students who complete the program in physical therapy. Physical therapy is a department in the Graduate School and additional information, including courses of instruction, may be found in the Graduate School bulletin which is available through the Office of Admissions, Graduate School, Duke University, Durham, North Carolina 27706. Graduate programs are also integral parts of Duke University Medical Center.

PHYSICAL THERAPY

Professor: Robert C. Bartlett, M.A., *Chairman*

Associate Professors: Pamela W. Duncan, Ph.D.; Margaret Schenkman, Ph.D.; Elia E. Villanueva, M.A.

Assistant Professor: Jan Gwyer, Ph.D., *Director of Graduate Studies*

Assistant Clinical Professors: Carol C. Figuers, M.S.; Mary Ellen Riordan, M.S.; Julie M. Chandler, M.S.

Clinical Associates: Linda M. Lawrence, B.S.; Daniel Dore, M.P.A.; Elizabeth Ross, M.S.

Adjunct Associates: Dennis Bongiorno, B.S.; Nicholas Caras, Ed.D.; Susan E. Harryman, M.S.;

Martha Propst, M.A.; Wadsworth D. Roy III, B.S.; Keith E. Varvel, M.P.H.

Emeriti: Eleanor Branch, Ph.D.; Grace Horton, B.S.

The Duke University Graduate Program in Physical Therapy, leading to the Master of Science degree, is a program for entry into the profession of physical therapy. The program is designed to provide a comprehensive foundation in the art and science of physical therapy, preparing individuals for clinical practice. Experiences in the areas of administration and research are also provided. Students may arrange their curricula to allow for the development of teaching skills.

Program of Study. The fully accredited program of study requires fifty-two credit units of graduate course work, research, clinical affiliation, or other equivalent academic experience, and is twenty-two consecutive months in length. Forty to forty-two units of work must be in physical therapy, seven units in designated courses in biological anthropology and anatomy, and neurobiology, and the remaining three to five units in electives in related fields.

A research project is required which provides the opportunity to pursue a particular aspect of physical therapy in-depth.

Prerequisites for Admission. Requirements for admission to the physical therapy program include a baccalaureate degree, completion of prerequisite courses, Graduate Record Examination (GRE) Aptitude Test scores, the filing of an application, and, upon invitation, a personal interview. It is strongly recommended that the GRE be taken no later than the October test date. Consult Graduate School application for deadline by which the application and all supportive documents must be received by the Graduate School Office of Admission. Only completed applications are forwarded to the Graduate Program in Physical Therapy. In order to meet the closing date of 3 January 1994, the GRE must be taken no later than the October test date. The application and all supportive documents must be received by the Graduate School Office of Admissions by 3 January and only completed applications are forwarded to the Graduate Program in Physical Therapy. No application forms are mailed after 3 December. Only students for full-time study are accepted. State of residency does not influence admission policies or tuition costs. Requests for applications and further information should be directed to the Director of Graduate Studies, Department of Physical Therapy, Box 3965, Duke University Medical Center, Durham, North Carolina 27710.

Tuition and Expenses. The 1993-94 academic year tuition for students enrolled in the Graduate Program in Physical Therapy is \$430 per credit unit. Estimated cost for the two-year program is approximately \$42,000, including tuition and living expenses.

Financial Aid. All students are encouraged individually to seek sources of financial assistance. Loan money may be available through the Duke University Medical Center. Financial aid applications are mailed to students after acceptance into the program. Please refer to the section on student aid in the chapter, "The Allied Health Programs." Physical therapy students are not eligible for fellowships, assistantships and traineeships offered by the Graduate School.



Certificate Programs

Duke University Medical Center has responded to the increased need for qualified individuals at all levels in the health care system by developing educational programs designed to equip people for a variety of positions. These programs, which vary in admission requirements and length of training, offer students both clinical and didactic experience. Graduates of these programs are awarded certificates.

Clinical Psychology Internship

Director of Clinical Training: W. Derek Shows, Ph.D.

The Division of Medical Psychology, Department of Psychiatry, Duke University Medical Center, offers internship training in clinical psychology to students who are currently enrolled in APA-approved Ph.D. programs in clinical psychology and who have already completed three years of graduate study. The program, approved by the American Psychological Association, provides experience in many contexts with a wide diversity of patients. Internship training provides experience in the traditional activities of clinical psychologists: assessment, consultation, treatment, and research. Those successfully completing the requirements for internship will be awarded a Duke University Medical Center certificate. Requests for additional information and correspondence concerning admission to the program should be directed to the Director, Clinical Psychology Internship Program, Box 3362, Duke University Medical Center, Durham, North Carolina 27710.

Clinical Pharmacy Practice Residency

Director, Clinical Pharmacy Residency: Christine Rudd, Pharm.D., F.C.C.P.

Director of Pharmacy Services: James C. McAllister, M.S.

Clinical Pharmacy Practice Residency is a twelve-month postgraduate program conducted by the Department of Pharmacy at the Duke University Medical Center. The residency is designed to give the graduate pharmacist extensive training in clinical pharmacy practice.

Admission Standards. Applicants must be graduates of accredited schools of pharmacy and must have a Pharm.D. degree. Residency candidates must demonstrate superior academic and leadership capabilities and be eligible for licensure in North Carolina. It is preferable that the applicant have previous hospital pharmacy experience.

Application Procedures. Applications must be submitted by early January of the year for which admission is requested and include the following:

1. ASHP resident matching program application code number;
2. official transcript from pharmacy school and other professional programs attended;
3. completed residency application forms; and
4. letters of recommendation from at least three persons who have known the applicant professionally (e.g., pharmacy school professor, hospital pharmacist, clinical pharmacist).

Applicants will be notified by 30 March regarding admission to the program. Requests for further information and application forms should be directed to the Director for Residency Training, Box 3089, Duke University Medical Center, Durham, North Carolina 27710.

Stipend. A stipend of \$28,000 is granted for the twelve-month residency.

Clinical Laboratory Science (Medical Technology)

Professor of Pathology: Salvatore V. Pizzo, M.D., Ph.D., *Chairman, Department of Pathology and Director of Clinical Laboratories*

Associate Professor of Pathology: Frances K. Widmann, M.D., *Medical Director, Clinical Laboratory Science Program*

Associate in Pathology: Margaret C. Schmidt, Ed.D., MT(ASCP)SH, CLS(NCA), CLSpH(NCA), *Program Director, Clinical Laboratory Science Program*

Assistant Program Director, Clinical Laboratory Science Program: Cynthia L. Wells, Ed.D., MT(ASCP), CLS(NCA)

Education Coordinators, Clinical Laboratory Science Program: Linda L. Seefried, M.A., MT(ASCP), CLSup(NCA); Barbara L. Burton, B.S., CLS/C(NCA), C(ASCP); Mary Ann Dotson, B.S., MT(ASCP), CLS(NCA); Patty Hanneman, M.S., MT(ASCP)SBB; Leslie W. Bard, B.S., MT(ASCP), CLS(NCA).

Professor: Lyman Barth Reller, M.D.

Associate Professors: Emily Reisner, Ph.D.; John Toffaletti, Ph.D.; Peter Zwadyk, Ph.D.

Assistant Professors: John A. Bittikofer, Ph.D.; Linda Charles, Ph.D., MT(ASCP); Steven Bredehoeft, M.D.

Medical Research Associate: Lizzie Harrell, Ph.D.

Instructors: Lee A. Barbieri, B.S., MT(ASCP); Donald Royster, CLPb(NCA).

Clinical Teaching Staff: Billy H. Abrams, B.A., MT(ASCP); Imad Aldroubi, MT(ASCP); Marilyn Alexieff, B.A., MT(ASCP); Yolanda Bell, B.S., MT(ASCP); Angela Blankenship-Rose, B.S., MT(ASCP); June Bumgarner, B.S., MT(ASCP)SBB; Mark Christy, B.A., M.H.S.; Adella Clark, B.S., MT(ASCP); Martha Rae Combs, B.S., MT(ASCP)SBB; Betty R. Crews, B.S., MT(ASCP); Gary Cudak, B.S., MT(ASCP); Brenda Deal, B.S., MT(ASCP); Mary Lynn Fiscus, B.S., MT(ASCP); Todd A. Hitch, B.S., MT(ASCP); Cathy Holleman, M.S., MT(ASCP)SC; Linda Issitt, B.S., MT(ASCP)SBB; Mary S. Jones, MT(HHS); Kelly Joyner, MT(ASCP)SH; Freda Kohan, B.S., MT(ASCP)SM; Janet Mueller, B.S., MT(ASCP); Beverly S. Oxford, B.S., MT(ASCP)SC; Ann Padgett, B.H.S., MT(ASCP)SM; Ruth Parrish; Theresa Pleasants, MT(HHS); Suzanne Schrack, MT(ASCP); Diana Souza, B.S., MT(ASCP); Sara Sparks, B.S., MT(ASCP).

Affiliate Institution Advisors: Robert K. Reid, Ph.D., *Meredith College*; Marsha E. Fanning, Ph.D., *Lenoir-Rhyne College*; Stephen R. Nohlgren, Ph.D., *Salem College*; Francis M. Knapp, Ph.D., *Stetson University*; Grover C. Miller, Ph.D., *North Carolina State University*; Steven Chalgren, Ph.D., *Radford University*; Karen E. Otto, Ph.D., *University of Tampa*; Roger Heintz, Ph.D., *State University of New York at Plattsburgh*; Neal Summerlin, Ph.D., *Lynchburg College*; Wilbur C. Jones, Ph.D., *Concord College*; Steven Kleman, Ph.D., *Rollins College*; Richard Heller, Ph.D., *Albright College*; Anne Kendrick, M.S., MT(ASCP), *University of North Carolina at Wilmington*; Craig Allee, Ph.D., *Shorter College*.

Program of Study. The educational program begins 1 June and consists of fifty-four instructional weeks which includes three weeks of vacation. The first four weeks consist of a core curriculum of courses offered to all students at the same time. After successful completion of the core curriculum, the student is eligible to begin forty weeks of coordinated coursework and clinical rotations in blocks of ten weeks each. After completion of the four major course and rotation blocks, a six-week term is devoted to a course of study in educational techniques, management and supervision, and quality assurance in health care. Lectures, student laboratory experience, and clinical laboratory instruction are presented by a faculty and staff of clinical laboratory scientists, physicians, chemists, and microbiologists.

Graduates of this CAHEA-accredited program are eligible for national certification as a clinical laboratory scientist. Career opportunities in hospital laboratories, research, public health facilities, and educational institutions are available. This program is formally affiliated with Meredith College, Raleigh, North Carolina; Lenoir-Rhyne College, Hickory, North Carolina; the University of Tampa, Tampa, Florida; Salem College, Winston-Salem, North Carolina; Stetson University, Deland, Florida; North Carolina State University, Raleigh, North Carolina; Radford University, Radford, Virginia; State University of New York at Plattsburgh, Plattsburgh, New York; Lynchburg College, Lynchburg, Virginia; Concord College, Athens, West Virginia; University of North Carolina at Wilmington, Wilmington, North Carolina; and Shorter College, Kome Georgia to provide the 3+1 study format toward a degree from these institutions. A cooperative agreement exists with Rollins College, Winter Park, Florida, and Albright College, Reading, Pennsylvania to channel 4+1 students to this program.

Prerequisites for Admission. Applicants to the program must possess the following academic prerequisites:

1. Possession of a baccalaureate degree, OR the completion of at least three years of study in an accredited college or university which totals ninety semester hours (120 quarter hours) with grades of C or better, and the written guarantee that a baccalaureate degree will be conferred by a university after successful completion of this program.
2. Four courses in major-track chemistry (including at least one course in organic chemistry).
3. Four courses in major-track biology (including one course in microbiology).
4. One course of college level mathematics.

Application Procedures. A completed application file contains the following:

1. The completed Duke University Medical Center Allied Health application form, including a nonrefundable processing fee;
2. Official transcript(s) from all colleges and universities attended;
3. Three letters of recommendation, one from a professor of biological sciences, one from a professor of chemistry, and one from a college advisor;
4. A personal interview with members of the Admissions Committee, if requested, following the receipt of the application and other information;
5. A written statement of interest in clinical laboratory science;
6. Evaluation of transcript credits earned outside the U. S. A., if requested.

The deadline for applications is 1 April of the year for which admission is requested. It is strongly recommended that applications be submitted by 15 December to receive timely consideration. Applications received after 15 December will be considered on a space-available basis. Applicants will be notified no later than 1 May regarding admission to the program. Requests for further information and application forms should be directed to the Clinical Laboratory Science Program Admissions, Box 2929, Education Service, Department of Pathology/Clinical Laboratories, Duke University Medical Center, Durham, North Carolina 27710.

Fees and Expenses. Tuition for the program is \$2,500*. A lab fee is charged for student labs. The student is responsible for housing, board, uniforms, books, and student health fee and medical insurance.

A nonrefundable deposit of \$175 is required of all accepted candidates to hold their place in the class. This deposit applies toward the tuition fee. The remaining tuition and fee balance is billed in two increments; at matriculation and in January (mid-year).

Transportation Required. The use of facilities other than Duke and Durham Veterans Administration Medical Centers requires transportation. It is the responsibility of each clinical laboratory science student to provide a means of transportation to and from the facilities selected for learning experiences. Although a few sites may be within bicycling distance, most are not.

Financial Aid. Please refer to the section on student aid in the chapter, "The Allied Health Programs". The program will provide information on the Hospital/Clinical Laboratories' Tuition Loan Program.

*Subject to change without prior notice.

Part-time Employment. Students who wish to work are eligible to compete for available part-time paid positions within hospital laboratories AFTER successful completion of the core curriculum and one major course and rotation block. Such positions are not to exceed a maximum of 19.9 hours per week.

Certification Examinations. Graduates of this program are eligible to sit for the national agency sponsored certification exam of their choice. Application forms and procedures will be provided and explained as a service to enrolled students during the clinical year of education. Consistent with Medical School Policy, this program considers certification to be the responsibility of the individual. This curriculum is not directed to prepare students specifically for certification examinations; however, satisfactory performance in this program should provide sufficient information and experience to pass a certification exam. The Program Certificate is not dependent upon passing a certification exam.

Courses of Instruction. Students must complete the following courses:

Core Curriculum*

<i>Course Title</i>	<i>Clock Hours</i>
	<i>Lect/Lab/Rotation</i>
Orientation Activities	35/00/00
CLS-103. Phlebotomy Principles and Procedures	08/00/40
CLS-107. Basic Principles of Immunology	35/00/00
CLS-110. Medical Application of Computers	15/15/00

Course and Rotational Blocks

<i>Course Title</i>	<i>Clock Hours</i>
	<i>Lect/Lab/Rotation</i>
CLS- 101. Issues in Clinical Laboratory Science	32/00/000
CLS-112. Biochemical Measurements and Disorders	114/40/246
CLS-120. Immunohematology	100/100/200
CLS-121. Blood and Body Fluids	115/125/160
CLS-132. Medical Microbiology/Serology	63/57/240

Program Final Term

<i>Course Title</i>	<i>Clock Hours</i>
	<i>Lec/Lab/Rotation</i>
CLS-113. Quality Assurance in Health Care	25/00/00
CLS-114. Elective/Alternate Site Rotation	00/00/40
CLS-124. Educational Techniques for the Health Professional	18/06/00
CLS-126. Laboratory Supervision and Management	26/00/00

Ophthalmic Medical Technician

Professor: W. Banks Anderson, M.D., *Medical Director*

Associate Professor: Judy H. Seaber, Ph.D., *Program Director*

Teaching Staff: Lois Duncan, CO, COMT; Barbara Suitt, R.N., COT, *Clinical Coordinator*

The ophthalmic medical technician program is sponsored by the Department of Ophthalmology, Duke University Medical Center. This is a one-year certificate course designed to prepare the student to perform adequately as an ophthalmic medical technician. The program consists of didactic lectures designed to provide the basic clinical background necessary for the student to understand and perform the technical tasks designated to them by an ophthalmologist. The educational program begins 1 July, and consists of forty-nine weeks of instruction with three weeks of vacation. The core curriculum will be covered within

*The failure of any course will prevent a student from continuing in the Clinical Laboratory Science Program.

the first six months supplemented by clinical experience under close supervision of clinical support staff and faculty. The second half of the program will consist of clinical rotations with the student working under the close supervision of qualified clinical support staff and faculty and evaluated on a routine basis as their skills develop.

Upon satisfactory completion of the course, students will receive certification from Duke University Medical Center and are eligible to sit for national certification examination by the Joint Commission of Allied Health Personnel in Ophthalmology at the level of ophthalmic medical technician.

Prerequisites for Admission. Applicants to the program must have two years of college or the equivalent.* Priority will be given to students with a college degree or extensive work experience in some field of ophthalmology.

Application Procedures. Applications must be received by 1 May of the year for which admission is requested and must contain the following:

1. the completed Duke University Medical Center Allied Health application form, including a nonrefundable processing fee;
2. official transcript(s) from all colleges and universities attended;
3. three letters of recommendation;
4. a personal interview with members of the admissions committee may be requested following receipt of the application and other information.

The deadline for applications is 1 May of the year for which admission is requested. It is strongly recommended that applications be submitted as early as possible. Applicants will be notified no later than 1 June regarding admission to the program. Requests for further information and application forms should be directed to the Program Director, Judy H. Seaber, Ph.D., Box 3802, Duke University Eye Center, Durham, North Carolina 27710.

Fees and Expenses. Tuition for the program is \$2,400. The student is responsible for housing, board, books, the student health fee and medical insurance. Fifty percent of the tuition is due at matriculation with the balance being due in January.

Transportation Required. It may be necessary for students to rotate at clinical sites other than at Duke University Medical Center and transportation may be necessary. It is the responsibility of the student to provide a means of transportation to and from the facility selected for learning experiences.

Financial Aid. Please refer to the section on student aid in the chapter, The Allied Health Programs.

Courses of Instruction. Students must satisfactorily complete the following courses. The curriculum will include but will not be limited to the following:

COURSE TITLE	CLOCK HOURS
Basic Science Lecture	150
Visual Acuity Assessment	10
Physiology and Anatomy of the Eye	10
Physical History	10
Cardiopulmonary Resuscitation	10
Instrument Maintenance	5
Visual Fields	40
Optics	40

*Decided by the admissions committee on an individual basis.

Spectacles	10
Pharmacology	5
Glaucoma	16
External Diseases	8
Physiology	12
Contact Lens	14
Ocular Motility	15
Neurology	5
General Psychology	5
Practicums, Clinical I, II, III, IV, V	TBA
TOTAL	365

Pastoral Care and Counseling

Associates in Instruction: Claude V. Deal, M.Div.; Margot K. Hover, D.Min.; M. Susan Nance, M.Div.; James A. Rawlings, Jr., M.Div.; James L. Travis, B.D., Th.M., Ph.D.

A graduate program in pastoral care and counseling is available to clergy, theological students, members of religious orders and lay persons of all religious faith groups. There are three levels of training and five distinct program structures of Clinical Pastoral Education offered at Duke University Medical Center. All programs are designed to train individuals who desire to specialize in pastoral care, to enhance their skills as parish clergy, or to broaden their understanding of ministry. With the exception of the Parish-Based Extended Basic CPE Program, all who enroll in any of the programs of Clinical Pastoral Education will be required to serve as chaplains in the Medical Center. All programs are accredited by the Association for Clinical Pastoral Education, Inc.

Programs of Study. The three training levels of Clinical Pastoral Education are basic, advanced, and supervisory. There are three distinct program structures of basic CPE including the summer fulltime basic CPE program (June-August), the hospital-based extended basic CPE program, and the parish-based extended basic CPE program. Extended basic CPE units are offered concurrently with the fall and spring semesters of Duke Divinity School. The fourth program structure is the year-long residency program, which begins in June and extends through the following May (four consecutive units). In the residency program, one may be at either a basic or advanced level of training. The fifth program structure is the supervisory CPE program for those seeking to be certified as a clinical pastoral education supervisor.

Requests for application and further information about any of the programs should be directed to the Director, Pastoral Services, Box 3112, Duke University Medical Center, Durham, North Carolina 27710. Admission procedures to each program include:

1. completion and submission of written application materials;
2. an admission interview by a qualified interviewer;
3. acceptance by the Duke University Medical Center CPE Center.

In addition to the above admission procedures, requirements for admission to specific CPE programs include:

1. Graduation from college and seminary-equivalences may be considered; and adequate ministry formation/development and experience in ministry which indicates readiness for this program (Residency CPE Program).
2. Ecclesiastical endorsement; pastoral experience of usually not less than three years; completion of program objectives of basic and advanced CPE; and consultation by the appropriate committee in the region with respect to his/her readiness to pursue supervisory training (Supervisory CPE).
3. Completion of a consultation process between a Duke University Medical Center CPE supervisor and a church board (Parish-Based Extended Basic CPE).

4. A personal interview with Duke University Medical Center faculty (residency and supervisory CPE).
5. Submission of previous basic CPE unit(s) final evaluation by student and supervisor(s) (residency and supervisory CPE).

Stipends and Fees. Stipends are available for students in the residency program and the supervisory CPE program. For 1993-94, the stipend for the residency program is \$16,750, and for the supervisory CPE program the stipend is \$20,000. There are no stipends available for summer fulltime and extended basic CPE units. Stipended students are eligible for the same benefit package as Duke University employees of comparable levels.

Tuition is \$375 per unit when enrolled through the Allied Health Division of Duke University Medical Center (\$325 for two or more consecutive units), and \$1,750 per unit when enrolled through Duke University Divinity School for academic credit. (A unit of CPE equals two academic courses.)

Fees include the following:

1. Application fee of \$30 must accompany an Allied Health form, unless applying with intention of enrolling through Duke University Divinity School.
2. \$55 per unit for Mid-Atlantic Region fee.
3. \$40 for admission interviews when requested.
4. \$100 tuition deposit for those accepted into the year-long residency program.
5. \$50 tuition deposit for students accepted into the summer fulltime and extended basic CPE programs.



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